Nuclear Science Abstracts

NUCLEAR SCIENCE ABSTRACTS

Vol. 6, No. 10, May 31, 1952

TABLE OF CONTENTS

ERRATA

NSA, Vol. 5, No. 24, page 1097. In Author Index, for Lindner, Manfred the abstract reference 5-8324 should read 5-7324.

NSA, Vol. 6, No. 8, p.304. In abstract 2390, the senior author should be Herbert J. Kouts.

NSA, Vol. 6, No. 8, p.314. In abstract 2476, the value -2.32 ± 0.07 mc in the fourth line should be -1.32 ± 0.07 Mc.

NSA, Vol. 6, No. 9, p.350. In abstract 2748, the authors are Harold Walchli, Ralph Livingston, and William J. Martin rather than B. C. Frazer and R. Pepinsky as printed.

REPORTS REFERENCE LIST

Vol. 6, No. 10

The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED REPORTS

AECD-3340 2927
Metallurgical Project, Mass. Inst. of Tech.
THE ROLE OF METALLURGY IN THE DEVELOPMENT OF ATOMIC POWER, by A. R. Kaufmann. Feb. 15, 1952. Decl. with deletions Mar. 3, 1952. 17p. (AECD-3340; MIT-1084)

AECD-3341 3104
Westinghouse Atomic Power Div.
DISPLACED ATOM DENSITIES IN CYCLOTRON IRRADIATED METALS, by F. C. Brooks. Jan. 4, 1952. Decl. Mar. 25, 1952. 11p. (AECD-3341; WAPD-RM-104)

AECD-3344 2874
Hanford Works
THE COULOMETRIC DETERMINATION OF URANIUM, by W. N. Carson, Jr. Dec. 3, 1951. Decl. with deletions Mar. 24, 1952. 23p. (AECD-3344; HW-22765)

AECD-3345 2934
Metallurgical Project, Mass. Inst. of Tech.
EFFECT OF SMALL ADDITIONS OF OXYGEN ON LATTICE CONSTANTS OF ZIRCONIUM, by R. M. Treco. Jan. 1952. Decl. Apr. 11, 1952. 17p. (AECD-3345; MIT-1079)

AECD-3346 2929
Metallurgical Project, Mass. Inst. of Tech.
SOME PROPERTIES OF HIGH-PURITY ZIRCONIUM AND DILUTE ALLOYS WITH OXYGEN, by R. M. Treco. Apr. 1951. Decl. with deletions Apr. 14, 1952. 36p. (AECD-3346; MIT-1056(Rev.))

AECD-3347 3053
Los Alamos Scientific Lab.
VELOCITIES OF FRAGMENTS FROM FISSION OF U^{233}, U^{235} AND Pu^{239}, by R. B. Leachman. [nd] Decl. Mar. 26, 1952. 16p. (AECD-3347; LADC-1058(Rev.))

AECD-3348 2976
Los Alamos Scientific Lab.
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AECU-1943 2861
Institute for the Study of Rate Processes, Univ. of Utah.
STUDIES OF PHOTOSYNTHETIC PROCESSES; ENERGY EXCHANGE IN PHOTO REACTIONS, by Rufus Lumry and Henry Eyring. July 1, 1951. 81p. (AECU-1943; Technical Report No. 1)

AECU-1944 2885
Institute for the Study of Rate Processes, Univ. of Utah
ELECTRODE REACTIONS OF ISOLATED CHLOROPLAST FRAGMENTS, by H. S. A. Gilmour, Rufus Lumry, and John D. Spikes. Dec. 1, 1951. 19p. (AECU-1944; Technical Report No. 3)

AECU-1945 2886
Institute for the Study of Rate Processes, Univ. of Utah
INHIBITION OF THE PHOTOCHEMICAL ACTIVITY OF ISOLATED CHLOROPLASTS. I. UNIVALENT IONS, by John D. Spikes, Rufus Lumry and John S. Rieske. Jan. 15, 1952. 25p. (AECU-1945; Technical Report No. 5)

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Wyoming Univ.
NUCLEAR MAGNETIC RESONANCE PROJECT; PROGRESS REPORT JULY 1, 1950 TO MARCH 15, 1951. [nd] 32p. (AECU-1946)

AECU-1947 2943
Knolls Atomic Power Lab.
THE END PROBLEM OF RECTANGULAR STRIPS, by G. Horvay. Mar. 12, 1952. 30p. (AECU-1947)

AECU-1948 2994
Los Alamos Scientific Lab.
MONOTONIC SET FUNCTIONS AND CONVEX SETS, by P. C. Hammer and Andrew Sobczyk. [nd] 19p. (AECU-1948; LADC-1142)

AECU-1949 2837
Lankenau Hospital Research Inst., Philadelphia
A STUDY OF PRECURSORS OF FORMATE IN THE INTACT RAT, by Sidney Weinhouse and Bernice Friedmann. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia. [nd] 15p. (AECU-1949)

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Illinois Inst. of Tech.
THE FUNDAMENTAL MECHANISMS FOR THE DECOMPOSITION OF ORGANIC MOLECULES BY METAL-PHOTOSENSITIZATION AND OTHER COLLISIONS OF THE SECOND KIND; PROGRESS REPORT FOR THE PERIOD JULY 1, 1949 TO FEBRUARY 28, 1950, by Harry E. Gunning. Mar. 1, 1950. 84p. (AECU-1950)

AECU-1951 3087
Nuclear Physics Lab., Washington Univ.
THE UNIVERSITY OF WASHINGTON 60 INCH CYCLOTRON; PROGRESS AND STATUS REPORT OF DESIGN AND CONSTRUCTION. June 1951. 100p. (AECU-1951)

AECU-1952 3126
Goodrich, B. F., Co.
STATUS REPORT; ELASTOMERIC MATERIALS AS SHIELDING COMPOUNDS FOR NUCLEAR REACTORS, by W. L. Davidson. Apr. 1, 1952. 16p. (AECU-1952)

AECU-1953 2856
Los Alamos Scientific Lab.
PHASE DIAGRAM OF DILUTE SOLUTIONS OF HE^3 IN HE^4

BELOW THE LAMBDA POINT, by H. S. Sommers, Jr. [nd]
54p. (AECU-1953; LADC-1150)

ANL-4778   2974
Argonne National Lab.
INSTRUMENT RESEARCH AND DEVELOPMENT DIVISION
QUARTERLY REPORT; DECEMBER, 1951, JANUARY AND
FEBRUARY, 1952. [nd] 13p. (ANL-4778)

ANL-4788   2902
Argonne National Lab.
THE CRYSTAL STRUCTURE OF NEPTUNIUM METAL, by
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BNL-149   2800
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QUARTERLY PROGRESS REPORT OCTOBER 1 - DECEM-
BER 31, 1951; UNCLASSIFIED SECTION. Issued March
1952. 50p. (BNL-149)

BNL-1137   2804
Brookhaven National Lab.
SUCROSE CONTENT IN THE STALKS OF MAIZE INBREDS,
by Robert Van Reen and W. Ralph Singleton. [nd] 20p.
(BNL-1137)

BNL-1139   2996
Brookhaven National Lab.
CHEMICAL DOSIMETRY USING FERROUS SULFATE AND
CERIC SULFATE SOLUTIONS, by Jerome Weiss. Mar. 26,
1952. 17p. (BNL-1139)

BNL-1140   3107
Brookhaven National Lab.
PAIR MEASUREMENT OF GAMMA-RAYS WITH A LENS
SPECTROMETER, by David E. Alburger. Mar. 6, 1952.
27p. (BNL-1140)

BNL-1141   2803
Brookhaven National Lab.
TRIOSEPHOSPHATE DEHYDROGENASE AND GLUCOSE-
6-PHOSPHATE DEHYDROGENASE IN THE PEA PLANT,
by Martin Gibbs. [nd] 5p. (BNL-1141)

BNL-1143   2855
Brookhaven National Lab.
NON-EXCHANGE OF OXYGEN BETWEEN WATER AND
SOME COMPOUNDS OF NITROGEN, by Francis Bonner and
Jacob Bigeleisen. [nd] 3p. (BNL-1143)

BNL-1144   2801
Brookhaven National Lab.
TWO NEW NUCLEOTIDES FROM RABBIT LIVER, by
Jacob Sacks and Leo Lutwak. [nd] 4p. (BNL-1144)

BNL-1145   2995
Brookhaven National Lab.
LIQUID SCINTILLATION COUNTERS, by C. E. Falk and
H. L. Poss. [nd] 37p. (BNL-1145)

BNL-1148   2802
Brookhaven National Lab.
MECHANISM OF ACTION OF ALKALINE PHOSPHATASE,
by Sylvia S. Stein and Daniel E. Koshland, Jr. [nd] 4p.
(BNL-1148)

CF-51-11-72   2930
Oak Ridge National Lab.
HIGH TEMPERATURE MECHANICAL PROPERTIES OF
METALS AND ALLOYS, by G. H. Boss. [nd] 21p. (CF-
51-11-72)

ISC-212   3073
Ames Lab.
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(ISC-212)

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Ames Lab.
SECONDARY ELECTRON SPECTRUM OF Pr^{142}, by Erling N.
Jensen, L. Jackson Laslett, and D. J. Zaffarano. Apr. 15,
1952. 7p. (ISC-218)

LA-1342   2992
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THE EVALUATION OF DEFINITE INTEGRALS, AND A
QUASI-MONTE-CARLO METHOD BASED ON THE PROP-
ERTIES OF ALGEBRAIC NUMBERS, by R. D. Richtmyer.
Oct. 13, 1951. 30p. (LA-1342)

LAMS-1312   3044
Los Alamos Scientific Lab.
THE TWO-PLATE METHOD OF MEASURING FAST NEU-
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INCIDENT NEUTRONS CANNOT BE DETERMINED, by John
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Mound Lab.
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Mar. 31, 1952. 6p. (MLM-680)

NYO-530   3042
Johns Hopkins Univ.
THE $3p^3\ 2s^3$ BANDS OF TH AND $T\frac{1}{2}$, by G. H. Dieke and B.
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Johns Hopkins Univ.
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NYO-602   2918
Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF
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et al. Apr. 1, 1952. (NYO-602)

NYO-620   2991
Wesleyan Univ., Middletown
SOME NEW MASS COMPARISONS INVOLVING Si, Fe, Ni,
Cu, Zn, W, AND Pt, by Henry E. Duckworth, Howard A.
Johnson, Richard S. Preston, and Richard F. Woodcock.
Mar. 16, 1950. 17p. (NYO-620)

NYO-621   3128
Wesleyan Univ., Middletown
MASSES OF Cr^{50}, Cr^{52} AND Fe^{54}, by Henry E. Duckworth
and Howard A. Johnson. Mar. 16, 1950. 6p. (NYO-621)

NYO-622   2989
Scott Lab. [of Physics], Wesleyan Univ., Middletown
MASSES OF Pd^{104}, Pd^{108}, Pt^{195} AND CU^{65}, by Henry E.
Duckworth, Karl S. Woodcock and Richard S. Preston. [nd]
4p. (NYO-622)

NYO-645   2947
Pennsylvania Univ.
THE MAGNETIC PROPERTIES OF SUPER-CONDUCTING
ALLOYS OF INDIUM AND THALLIUM, by E. Callen, W. F.
Love and F. C. Nix. Issued July 3, 1951. 17p. (NYO-645)

NYO-646   2944
Pennsylvania Univ.
SOME OBSERVATIONS OF RESISTANCE HYSTERESIS IN
THE SUPERCONDUCTIVE TRANSITION, by W. F. Love.
Issued July 3 1951. 8p. (NYO-646)

NYO-647   2945
Pennsylvania Univ.
THE DE HAAS-VAN ALPHEN EFFECT, by F. J. Donahoe,

W. F. Love and F. C. Nix. Issued July 3, 1951. 15p.
(NYO- 647)

NYO-674   3106
Johns Hopkins Univ.
STUDIES OF NUCLEAR GAMMA RAYS; ANNUAL REPORT,
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NYO-678   3055
Wesleyan Univ., Middletown
EVIDENCE FOR MAGIC NUMBERS FROM SOME RECENT
ATOMIC MASS MEASUREMENTS, by Henry E. Duckworth
and Richard S. Preston. Nov. 20, 1950. 28p. (NYO-678)

NYO-680   3054
Wesleyan Univ., Middletown
SOME NEW VALUES OF ATOMIC MASSES, PRINCIPALLY
IN THE REGION OF 82 NEUTRONS, by H. E. Duckworth,
Cort L. Kegley, John M. Olson and George S. Stanford.
May 30, 1951. 17p. (NYO-680)

NYO-692   3127
Johns Hopkins Univ.
SOME HIGHER ELECTRONIC STATES IN THE MOLECULAR
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(NYO-692)

NYO-693   2895
Johns Hopkins Univ.
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SPECTRA III; ANNUAL REPORT, by G. H. Dieke. Nov.
1951. 33p. (NYO-693)

NYO-824   2990
Connecticut Univ.
GEIGER-MÜLLER COUNTER RESEARCH WITH MASS
SPECTROSCOPY, by Stephen S. Friedland and Henry S.
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NYO-974   2954
Syracuse Univ.
PROGRESS LETTER, by Kurt Sitte. July 28, 1951. 2p.
(NYO-974)

NYO-1575   2913
Little, Arthur D., Inc.
INVESTIGATION OF STACK GAS FILTERING REQUIRE-
MENTS AND DEVELOPMENT OF SUITABLE FILTERS;
SUMMARY REPORT. Issued June 30, 1951. 48p. (NYO-
1575)

NYO-3035   3105
Rochester Univ.
SHELL MODEL PREDICTIONS IN BETA-DECAY, by
Albert G. Petschek. Nov. 10, 1951. 24p. (NYO-3035)

NYO-3048   3004
Rochester Univ.
CONSTRUCTION AND CALIBRATION OF A FAST NEUTRON
SCINTILLATION SPECTROMETER, by G. L. Guernsey,
G. R. Mott, B. K. Nelson, and A. Roberts. Apr. 4, 1952.
20p. (NYO-3048)

NYO-3049   3014
Rochester Univ.
THE ABSORPTION OF SLOW π^- MESONS BY He^3, by A. M.
L. Messiah. Mar. 24, 1952. 29p. (NYO-3049)

NYO-3088   2909
Columbia Univ.
MASS TRANSFER IN LIQUID METAL AND FUSED SALT
SYSTEMS; THIRD QUARTERLY PROGRESS REPORT, by
Charles F. Bonilla, Bernard Gross, Fred Kant, R. N.
Roy-Choudhury, and N. S. Shaikhmahmud. Mar. 1, 1952.
(NYO-3088)

NYO-3139   2924
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELE-
VATED TEMPERATURES, by F. H. Norton and W. D.
Kingery, et al. Apr. 1, 1952. (NYO-3139)

NYO-3157   3015
New York Univ.
PROGRESS REPORT FOR THE PERIOD, NOVEMBER 1,
1950 TO SEPTEMBER 1, 1951, by M. H. Shamos. [nd]
73p. (NYO-3157)

NYO-3202   2999
Rochester Univ.
A COAXIAL CABLE DRIVER WITH GAIN, by Kurt Enslein.
7p. (NYO-3202)

NYO-3207   3016
Rochester Univ.
DECAY OF A NEUTRAL SCALAR HEAVY MESON, by H. P.
Noyes. Mar. 31, 1952. 21p. (NYO-3207)

NYO-3209   3074
Rochester Univ.
THE PARITIES OF THE GROUND STATES OF N^{14} AND C^{14},
by D. A. Bromley and L. M. Goldman. Apr. 10, 1952. 5p.
(NYO-3209)

NYO-3210   2998
Rochester Univ.
A FAST COINCIDENCE USING A GATED-BEAM TUBE, by
Kurt Enslein. Apr. 3, 1952. 3p. (NYO-3210)

NYO-3276   2857
Connecticut Univ.
REPORT ON DISTRIBUTION STUDIES BETWEEN MELTS
AND SOLID PHASES USING RADIOACTIVE TRACERS, by
J. J. Casey, John Looby, and Roland Ward. Feb. 29, 1952.
27p. (NYO-3276)

ORNL-1252   2878
Oak Ridge National Lab., Y-12 Area
GENERAL INFORMATION CONCERNING FLUORIDES, by
Mary E. Lee. Feb. 19, 1952. 86p. (ORNL-1252)

TID-5078   2986
Technical Information Service, AEC
RADIOISOTOPE APPLICATIONS OF INDUSTRIAL SIGNIFI-
CANCE; AS LISTED IN "ISOTOPES—A FIVE-YEAR SUM-
MARY OF U. S. DISTRIBUTION." [nd] 64p. (TID-5078)

UCLA-190   2805
Atomic Energy Project, Univ. of Calif.
EXTRACTION OF PRODIGIOSIN FROM BLOOD PLASMA
AND BODY TISSUES AND ITS MEASUREMENT BY SPEC-
TROPHOTOMETRIC ANALYSIS, by George V. Taplin,
James S. Grevior, Clayton H. Douglas, Arthur Dunn, Camille
Finnegan and Mary Louise LaNier. Mar. 20, 1952. 12p.
(UCLA-190)

UCLA-192   3003
Atomic Energy Project, Univ. of Calif., Los Angeles
THE CHLOROFORM-ALCOHOL-DYE SYSTEM, by George
V. Taplin, Clayton H. Douglas, and Sanford C. Sigoloff.
Issued Apr. 2, 1952. 20p. (UCLA-192)

UCRL-1250   2946
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF
APRIL 19, 1951, by Bonnie E. Cushman. Sept. 17, 1951.
9p. (UCRL-1250)

UCRL-1410(Rev.)   3090
Radiation Lab., Univ. of Calif.
THE SCATTERING OF PROTONS FROM CARBON, by
Peter A. Wolff. Mar. 12, 1952. 21p. (UCRL-1410(Rev.))

UCRL-1635   2997
Radiation Lab., Univ. of Calif.
SURVEY METHODS FOR NEUTRON FIELDS, by Burton J.
Moyer. Jan. 11, 1952. 39p. (UCRL-1635)

UCRL-1646   2978
Radiation Lab., Univ. of Calif.
PERFORMANCE OF CERENKOV DETECTOR, by J. W.
Mather and E. A. Martinelli. Mar. 6, 1952. 7p. (UCRL-
1646)

UCRL-1668   2903
Radiation Lab., Univ. of Calif.
THE HEAT OF SOLUTION OF NEPTUNIUM METAL AND
THE HEATS OF FORMATION OF SOME NEPTUNIUM
CHLORIDES. A MICROCALORIMETER FOR HEAT OF
SOLUTION MEASUREMENTS, by Edgar F. Westrum, Jr.
and LeRoy Eyring. Feb. 7, 1952. 17p. (UCRL-1668)

UCRL-1691   3076
Radiation Lab., Univ. of Calif.
FAST MESON INTERACTIONS IN NUCLEAR EMULSIONS.
PART I: ON π-MESONS, by Hugh Bradner and Bayard
Rankin. Feb. 25, 1952. 26p. (UCRL-1691)

UCRL-1693   3000
Radiation Lab., Univ. of Calif.
HIGH ENERGY PARTICLES AND THE SCINTILLATION
COUNTER, by L. F. Wouters. Feb. 26, 1952. 29p. (UCRL-
1693)

UCRL-1694   2808
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MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT;
OCTOBER, NOVEMBER AND DECEMBER 1951. Feb. 28,
1952. 113p. (UCRL-1694)

UCRL-1694(p.2-38)   2809
Radiation Lab., Univ. of Calif.
THE METABOLIC PROPERTIES OF VARIOUS MATERIALS,
p.2-38 of MEDICAL AND HEALTH PHYSICS QUARTERLY
REPORT; OCTOBER, NOVEMBER AND DECEMBER 1951.
Feb. 28, 1952. 37p. (UCRL-1694(p.2-38))

UCRL-1694(p.39-113)   2810
Radiation Lab., Univ. of Calif.
BIOLOGICAL STUDIES OF RADIATION EFFECTS, AND
HEALTH CHEMISTRY AND PHYSICS, p.39-113 of MEDICAL
AND HEALTH PHYSICS QUARTERLY REPORT; OCTOBER,
NOVEMBER AND DECEMBER 1951. Feb. 28, 1952. 75p.
(UCRL-1694(p.39-113))

UCRL-1697   3086
Radiation Lab., Univ. of Calif.
D-C DRAIN AND BREAKDOWN PHENOMENA FOR UNOUT-
GASSED METALS, by H. G. Heard. Mar. 1952. 31p.
(UCRL-1697)

UCRL-1709   3077
Radiation Lab., Univ. of Calif.
MOMENTUM TRANSFER IN NUCLEAR EXCITATION BY
HIGH ENERGY PARTICLES, by Si-Chang Fung and I.
Perlman. Mar. 11, 1952. 20p. (UCRL-1709)

UCRL-1719   2899
Radiation Lab., Univ. of Calif.
PREPARATION OF RADIOACTIVE IODOTRIPHENYL-
ETHYLENE, by D. C. Morrison. Mar. 1952. 4p.
(UCRL-1719)

UCRL-1721   2896
Radiation Lab., Univ. of Calif.
INFRARED SPECTRA OF BRANCHED LONG-CHAIN FATTY
ACIDS, by N. K. Freeman. Mar. 1952. 22p. (UCRL-
1721)

UCRL-1725   3108
Radiation Lab., Univ. of Calif.
THE ALPHA PARTICLES OF RADIUM, by F. Asaro and
I. Perlman. Mar. 13, 1952. 7p. (UCRL-1725)

UCRL-1735   3089
Radiation Lab., Univ. of Calif.
PROTON-PROTON COLLISIONS WITHIN LITHIUM NUCLEI,
by Owen Chamberlain and Emilio Segrè. Mar. 20, 1952.
10p. (UCRL-1735)

UCRL-1742   2969
Radiation Lab., Univ. of Calif.
EXPERIMENTAL EVIDENCE FOR CLASSICAL ELECTRON
RADIATION, by Joseph W. Mather. Mar. 28, 1952. 6p.
(UCRL-1742)

UR-191   2823
Atomic Energy Project, Univ. of Rochester
SOME POTENTIAL HAZARDS OF THE WIDESPREAD USE
OF ROENTGEN RAYS IN PEDIATRICS, by Robert W.
Miller. Mar. 13, 1952. 24p. (UR-191)

UR-192   2833
Atomic Energy Project, Univ. of Rochester
THE TOXICITY AND URINARY EXCRETION OF CRYS-
TALLINE METAPHOSPHATES, by R. E. Gosselin, E. A.
Maynard, W. L. Downs, G. J. Miller, H. L. Berke and H. C.
Hodge. Mar. 18, 1952. 22p. (UR-192)

Y-F10-14   3071*
Carbide and Carbon Chemicals Co. (Y-12)
ADVANCED SEMINAR IN REACTOR PHYSICS, by Nicholas
M. Smith, Jr. Mar. 27, 1950. 10p. (Y-F10-14)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE C/M-131   2872
[Atomic Energy Research Establishment, Harwell, Berks
(England)]
A METHOD FOR THE AMPEROMETRIC TITRATION OF
THORIUM, by A. A. Smales and L. Airey. [nd] 6p.
(AERE C/M-131)

AERE-C/R-801   2860
Atomic Energy Research Establishment, Harwell, Berks
(England)
SOME ASPECTS OF THE SOLUTION CHEMISTRY OF ZIR-
CONIUM, by B. A. J. Lister and L. A. McDonald. Oct. 26,
1951. 52p. (AERE-C/R-801)

AERE C/R-808   2859
Atomic Energy Research Establishment, Harwell, Berks
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THE THERMODYNAMICS OF CATION EXCHANGERS. I.
THE PREDICTION OF EQUILIBRIUM CONSTANTS FROM
OSMOTIC DATA, by E. Glueckauf and J. F. Duncan. 1951.
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Atomic Energy Research Establishment, Harwell, Berks
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THE CHEMICAL MANIPULATION OF 200-GRAM AMOUNTS
OF IRRADIATED THALLIUM AT THE ACTIVITY LEVEL OF
ABOUT 5 CURIES OF Ti^{204}; THE REACTION $Ti^{203}(n,p)Hg^{203}$,
by W. J. Arrol, J. Chadwick, and J. Eakins. Mar. 7, 1952.
9p. (AERE I/M-16)

AERE M/R-837   2914
[Atomic Energy Research Establishment, Harwell, Berks]
(England)
INDENTATION CREEP OF COMMERCIALLY PURE ALU-
MINIUM, by K. G. Robinson. [nd] 17p. (AERE M/R-837)

AERE M/R-839   2915
[Atomic Energy Research Establishment, Harwell, Berks]
(England)
INDENTATION CREEP OF 99.8% ALUMINIUM, by K. G.
Robinson. [nd] 14p. (AERE M/R-839)

AERE M/R-843   2925
Atomic Energy Research Establishment, Harwell, Berks
(England)
EFFECTS ASSOCIATED WITH THE FLOW OF VACANCIES
IN INTERMETALLIC DIFFUSION, by R. S. Barnes. Jan. 1,
1952. 25p. (AERE M/R-843)

AERE T/R-826   3072
Atomic Energy Research Establishment, Harwell, Berks
(England)
A NEW METHOD FOR CALCULATING THE CRITICAL
RADIUS OF SYSTEMS CONTAINING HYDROGEN AND
FISSILE MATERIAL, by B. Davison. Jan. 1952. 51p.
(AERE T/R-826)

BM-RI-4858   2862
Bureau of Mines
ELECTRICAL CONDUCTIVITY AND DENSITY OF FUSED
BINARY MIXTURES OF MAGNESIUM CHLORIDE AND
OTHER CHLORIDES, by R. W. Huber, E. V. Potter and H.
W. St. Clair. Mar. 1952. 14p. (BM-RI-4858)

IM-6   2971
Atomic Energy Project (Canada)
OPERATING AND TECHNICAL MANUAL; GENERAL
PURPOSE COUNTING-RATE METER AEP 1902, by R. J.
Cox. Mar. 10, 1950. 30p. (IM-6; NRC-2398)

IM-9   2975
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HIGH SPEED SCALE X 8 TYPE AEP 908-1, by W. D.
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NP-3107   2979
Research Lab. of Electronics, Mass. Inst. of Tech.
EXPERIMENTAL STUDY OF OPTIMUM FILTERS, by
Charles A. Stutt. May 15, 1951. 127p. (NP-3107; Techni-
cal Report No. 182; U17505)

NP-3130   2968
Research Lab. of Electronics, Mass. Inst. of Tech.
HIGH-FREQUENCY GAS DISCHARGE BREAKDOWN, by
Sanborn C. Brown. Apr. 12, 1951. 15p. (NP-3130;
Technical Report No. 195; U17867)

NP-3670   2931
Institute of Engineering Research, Univ. of Calif.
EFFECT OF ALLOYING ELEMENTS ON GRAIN BOUNDARY
RELAXATION IN ALPHA SOLID SOLUTIONS OF ALUMI-
NUM, by C. D. Starr, E. C. Vicars, A. Goldberg and J. E.
Dorn. Jan. 1952. 53p. (NP-3670; U21265)

NP-3678   2879
Washington Univ., St. Louis
STUDIES IN HYDROGEN FLUORIDE (thesis), by Albert
William Jache. Feb. 1952. 46p. (NP-3678; U21220)

NP-3679   2973
Research Lab. of Electronics, Mass. Inst. of Tech.
INTERACTION OF MODES IN MAGNETRON OSCILLATORS,
by R. R. Moats. June 25, 1951. 55p. (NP-3679; Tech-
nical Report No. 171; U21245)

NP-3688   2926
Armour Research Foundation
DEVELOPMENT OF PROTECTIVE COATING FOR TITA-
NIUM AND TITANIUM ALLOYS; INTERIM TECHNICAL
REPORT NO. 2, OCTOBER 1, 1951–JANUARY 31, 1952, by
William H. Colner, Morris Feinleib and Howard T. Francis
[nd] 11p. (NP-3688; Interim Technical Report No. 2;
U21434)

NP-3693   2933
Metallurgical Labs., Sylvania Electric Products, Inc.
MECHANICAL PROPERTIES OF TITANIUM; THIRD
QUARTERLY PROGRESS REPORT, PART II, MAY 1, 1951
TO AUGUST 1, 1951 (Final Technical Report), by F. D. Rosi,

F. C. Perkins, and B. H. Alexander. Issued Feb. 15, 1952.
47p. (NP-3693)

NP-3694   2993
Massachusetts Inst. of Tech.
MACHINE METHODS OF COMPUTATION AND NUMERI-
CAL ANALYSIS. Dec. 15, 1951. 14p. (NP-3694; Quarterly
Progress Report No. 2; U20928)

NP-3696   2876
Dow Chemical Co.
THE EFFECT OF TEMPERATURE ON THE LATTICE
PARAMETERS OF MAGNESIUM ALLOYS, by R. S. Busk.
[nd] 9p. (NP-3696)

NP-3697   2928
[Massachusetts Inst. of Tech.]
OBSERVATIONS OF CREEP OF THE GRAIN BOUNDARY
IN HIGH PURITY ALUMINUM, by Hsing Chien Chang and
Nicholas J. Grant. [nd] 21p. (NP-3697)

NP-3700   2910*
Brooklyn Polytechnic Inst.
A THEORETICAL INVESTIGATION OF THE TEMPERA-
TURE FIELD IN THE LAMINAR BOUNDARY LAYER ON A
POROUS FLAT PLATE WITH FLUID INJECTION, by Shao
Wen Yuan. Sept. 5, 1947. 26p. (NP-3700; Technical Re-
port No. 4)

NP-3701   3041
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PAR-
TICULATE MATTER IN THE LOWER LAYERS OF THE
ATMOSPHERE, by E. Wendell Hewson. Aug. 10, 1951.
42p. (NP-3701; Progress Report No. 11)

NP-3726   2907
Bureau of Yards and Docks
DESIGN OF PROTECTIVE STRUCTURES (A NEW CON-
CEPT OF STRUCTURAL BEHAVIOR), by Arsham Amirikian.
Aug. 1950. 76p. (NP-3726; NavDocks P-51)

NP-3727   2838
Naval Medical Research Inst., Bethesda
INFLUENCE OF VITAMIN D ON DEPOSITION OF GALLIUM
IN BONE, by H. C. Dudley and Leo Friedman. July 9, 1951.
7p. (NP-3727; Memorandum Report 51-9)

NP-3747   2920
[Metals Corrosion Lab., Bureau of Mines]
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM
METALS; SEMIANNUAL REPORT FOR JUNE 1951, by L. B.
Golden, I. R. Lane, Jr., J. T. Pons, W. R. Acherman, and
W. Mace. [nd] 41p. (NP-3747)

NP-3748   2921
Metals Corrosion Lab., Bureau of Mines
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM
METALS; SEMIANNUAL REPORT FOR JULY-DECEMBER
1951, by L. B. Golden, D. Schlain, I. R. Lane, Jr., W. L.
Acherman, and W. Mace. [nd] 47p. (NP-3748)

NP-3761   2985
Tracerlab Inc.
INDUSTRIAL APPLICATIONS OF RADIOISOTOPES; A
SELECTED BIBLIOGRAPHY, by Jerome Kohl, comp. Jan.
3, 1952. 9p. (NP-3761)

NRL-3535   2972*
Naval Research Lab.
UPPER ATMOSPHERE RESEARCH REPORT NO. X; THE
MATRIX TELEMETERING SYSTEM, by J. T. Mengel,
N. R. Best, D. G. Mazur, and K. M. Uglow. Sept. 19, 1949.
91p. (NRL-3535)

NRL-3948   3002
Naval Research Lab.
AGING CHARACTERISTICS OF GEIGER TUBES, by S. W.

Lichtman and R. W. Kreplin. Mar. 18, 1952. 11p. (NRL-3948)

NRL-3953   3001
Naval Research Lab.
HIGH IMPEDANCE CHAMBERS, by D. S. Toffolo. Mar. 26, 1952. 4p. (NRL-3953)

PR-P-13-E   2977
Atomic Energy Project (Canada)
PROGRESS REPORT NOVEMBER 16, 1951—FEBRUARY 15, 1952, ELECTRONICS BRANCH, by J. Hardwick. [nd] 15p. (PR-P-13-E)

SO-2020   2932
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY;

THIRTEENTH QUARTERLY REPORT, by J. H. Hollomon and D. Turnbull. Apr. 5, 1952. 8p. (SO-2020; Progress Report No. 30)

TEM-335   2873
Geological Survey
A NEW SERIES OF IMMERSION LIQUIDS, by Robert Meyrowitz. Mar. 1952. 9p. (TEM-335)

USNRDL-339   2824
Naval Radiological Defense Lab.
PROTECTION OF MICE AGAINST X-IRRADIATION BY SPLEEN HOMOGENATES ADMINISTERED AFTER EXPOSURE, by L. J. Cole, M. C. Fishler, M. E. Ellis, and V. P. Bond. Jan. 15, 1952. 18p. (USNRDL-339; U21254)

GENERAL

RESEARCH PROGRAMS

2800

Brookhaven National Lab.
QUARTERLY PROGRESS REPORT OCTOBER 1 - DECEMBER 31, 1951; UNCLASSIFIED SECTION. Issued March 1952. 50p. (BNL-149)

This report covers unclassified research progress in the fields of physics, instrumentation and health physics, accelerators, chemistry, reactor science and engineering, biology, and medicine. Abstracts of journal publications and summaries of papers presented at meetings are included. New research programs that were started during the quarter are mentioned and a few of the important scientific achievements of the quarter that have not yet reached the point of formal publication are mentioned.

BIOLOGY AND MEDICINE

2801

Brookhaven National Lab.
TWO NEW NUCLEOTIDES FROM RABBIT LIVER, by Jacob Sacks and Leo Lutwak. [nd] 4p. (BNL-1144)

Properties of two new substances, which appear to be polyphosphate derivatives of adenine nucleotides, obtained from trichloroacetic acid extracts of rabbit liver, are discussed.

2802

Brookhaven National Lab.
MECHANISM OF ACTION OF ALKALINE PHOSPHATASE, by Sylvia S. Stein and Daniel E. Koshland, Jr. [nd] 4p. (BNL-1148)

An investigation was made of the mechanism of alkaline phosphatase activity involving a nucleophilic attack on the phosphorus atom with displacement of the -OR group of the substrate. Data on enzymatic hydrolysis of phosphate esters in H_2O and phosphatase catalyzed exchange of O between inorganic phosphate and water are presented in tabular form.

2803

Brookhaven National Lab.
TRIOSEPHOSPHATE DEHYDROGENASE AND GLUCOSE-6-PHOSPHATE DEHYDROGENASE IN THE PEA PLANT, by Martin Gibbs. [nd] 5p. (BNL-1141)

Extracts of roots, stems, and leaves of pea plants were found to contain enzymes which catalyze the oxidation of glyceraldehyde-3-phosphate with the pyridine nucleotides. There appeared to be two enzymes in stem and leaf, one requiring triphosphopyridine nucleotide, the other diphosphopyridine nucleotide. The enzyme in the root was found to be active only with the latter nucleotide. The activity of the triosephosphate dehydrogenases as indicated by reduction of the nucleotides by glyceraldehyde-3-phosphate is presented graphically. Glucose-6-phosphate dehydrogenase in roots, stems, and leaves was found to be active only with triphosphopyridine nucleotide.

2804

Brookhaven National Lab.
SUCROSE CONTENT IN THE STALKS OF MAIZE INBREDS, by Robert Van Reen and W. Ralph Singleton. [nd] 20p. (BNL-1137)

Sucrose determinations and Brix readings on the stalk juice were made on five field corn inbreds. There was a good correlation within each inbred between Brix reading and sucrose content. Sucrose content in maize stalks increased rapidly from the late whorl stage (first sampling period) through the pollination period, about one month later, and during the early stages of ear development. During later stages of ear development the sucrose content in the stalks decreased, showing a translocation of the stored carbohydrates to the ear.

2805

Atomic Energy Project, Univ. of Calif.
EXTRACTION OF PRODIGIOSIN FROM BLOOD PLASMA AND BODY TISSUES AND ITS MEASUREMENT BY SPECTROPHOTOMETRIC ANALYSIS, by George V. Taplin, James S. Grevior, Clayton H. Douglas, Arthur Dunn, Camille Finnegan and Mary Louise LaNier. Mar. 20, 1952. 12p. (UCLA-190)

Satisfactory methods have been developed to extract prodigiosin from samples of blood plasma and various body tissues following administration of the dye. They depend on the preferential solubility of the dye in petroleum ether or in acid chloroform over that in blood plasma or in tissue fluids. The concentration of prodigiosin in these extracts may be measured accurately by spectrophotometric analysis, using the appropriate wave lengths of the absorption band of the dye in the solvents. Amounts as small as $0.1 \mu g/ml$ may be detected in a reproducible manner. (auth)

2806

BIOSYNTHESIS OF RADIOACTIVE NICOTINE. A. Ganz, F. E. Kelsey, and E. M. K. Geiling. Botan. Gaz. 113, 195-203 (1951) Dec.

Using the photosynthetic mechanism of the tobacco plant to incorporate radioactive carbon dioxide into its constituents, radioactive nicotine has been prepared. The highest activity of radioactive nicotine obtained was 501,000 cpm/mg (0.3503 $\mu c/mg$). A highly convenient and sensitive spectrophotometric method has been developed for the analysis of nicotine in tobacco extracts. The identity of the extracted and purified material as nicotine is evidenced by spectrophotometric and by melting-point data, by precipitation and solubility characteristics, and by biological action on mice and frogs. The value of the specific radioactivity of extracted nicotine per unit of radioactivity administered to the plant is roughly constant when different amounts of radioactivity are given to young tobacco plants. This value averaged 529 cpm/mg of nicotine/microcurie of radiocarbon injected as $C^{14}O_2$. (auth)

2807

UPTAKE OF DEUTERIUM INTO PROTEINS OF FERTILIZED AND UNFERTILIZED ARBACIA EGGS SUSPENDED IN HEAVY WATER. Henry D. Hoberman, Charles B. Metz, and Jack Graff. J. Gen. Physiol. 35, 639-43(1952) Mar.

When fertilized and unfertilized eggs of Arbacia punctulata are suspended in heavy water, deuterium is incorporated into

stable positions in the egg proteins. The rate of incorporation of the isotope is considerably greater in fertilized than in unfertilized eggs, and is accelerated at the time of formation of the blastula. The result of calculation of the maximum deuterium concentration which would be reached on complete turnover indicates that at least one out of every ten stably bound hydrogen atoms of the egg proteins is a deuterium atom. This has been interpreted as evidence that at the time of formation of the sea urchin blastula and in the period of development which follows, synthesis and breakdown are simultaneous processes leading to the redistribution of amino acids among the egg proteins.

RADIATION EFFECTS

2808
Radiation Lab., Univ. of Calif.
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; OCTOBER, NOVEMBER AND DECEMBER 1951. Feb. 28, 1952. 113p. (UCRL-1694)

Separate abstracts have been prepared on the following sections of this report: The Metabolic Properties of Various Materials, p.2-38; and Biological Studies of Radiation Effects, and Health Chemistry and Physics, p.39-113.

2809
Radiation Lab., Univ. of Calif.
THE METABOLIC PROPERTIES OF VARIOUS MATERIALS, p.2-38 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; OCTOBER, NOVEMBER AND DECEMBER 1951. Feb. 28, 1952. 37p. (UCRL-1694(p.2-38))

The findings are presented from a preliminary study of the deposition and fate of Pu inhaled as aerosols in rats in which histological lung sections were compared with radioautograms. Two monkeys given intra-ocular astatine injections showed complete destruction of the thyroid tissue when sacrificed after 4 months. A third monkey given At injections evidenced signs and symptoms characteristic of human myxedema after 6 months. The recuperative effect of thyroid substances was impressive. Continued observations are planned. Data from tissue distribution studies of Tl and W are presented in tabular form. A marked enhancement of excretion of injected Pu and radioyttrium was observed following the administration of calcium ethylendiamine tetraacetic acid and Fe-3 as chelating agents. Data obtained from studies of the induced oxidation of ferrous sulphate and ferrous ammonium sulphate systems by He-ion bombardment are included. Papers on the radiation chemistry of aqueous solutions containing both ferrous ion and Co_2 already published and in press are listed.

2810
Radiation Lab., Univ. of Calif.
BIOLOGICAL STUDIES OF RADIATION EFFECTS, AND HEALTH CHEMISTRY AND PHYSICS, p.39-113 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; OCTOBER, NOVEMBER AND DECEMBER 1951. Feb. 28, 1952. 75p. (UCRL-1694(p.39-113))

From a study of the role of the nucleus in x-ray-induced deferred death in yeast it was concluded that radiation-induced deferred death in both haploid and diploid yeast cells is the result of the inhibition of the nuclear division of the irradiated cell without inhibition of cell growth. Ferro-kinetic abnormalities in diseases with anemia were studied by the Fe turnover method using Fe^{59} globulin. Serial in vivo radioactivity measurements at marrow, liver, and spleen sites as well as sampling of plasma and cells were made subsequent to instantaneous labeling of the plasma globulin Fe. All measurements were made using high-efficiency fluorescence counters. Representative tissue volumes of liver, spleen, and marrow were serially followed using external directional detectors. Data from 22 cases are compared with normal controls. Techniques for the survey of slow neutrons, methods of measurement of fast neutrons, and methods for estimation of high-energy neutron flux densities are discussed.

2811
THE EFFECT OF TOTAL BODY X IRRADIATION ON THE SUSCEPTIBILITY OF MICE TO INFLUENZA A VIRUS INFECTION. Ernest Beutler and Horace M. Gezon. J. Immunol. 68, 227-42(1952) March.

There appeared to be one difference between the histopathological course of infection in x-irradiated and non-irradiated mice exposed to influenza virus.

2812
EFFECT OF IRRADIATION ON THE UNIVERSAL REACTION IN CANCER. Reuben L. Kahn, Fred J. Hodges, Isadore Lampe, and Owen W. Doyle. Cancer Research 12, 170-5 (1952) Mar.

Preliminary studies of universal reactions before and after irradiation of cancer patients led to the following results. Patients whose universal reactions exhibited a rise in precipitation following irradiation were found to manifest clinically a normal post-irradiation course. Patients whose universal reactions exhibited no rise or a decline in precipitation following irradiation were found to be in a very poor state clinically and did not manifest a normal post-irradiation course.

2813
EFFECT OF IRRADIATION ON THE UNIVERSAL REACTION IN POLYCYTHEMIA VERA. Reuben L. Kahn, William H. Bullock, and Frank H. Bethell. Cancer Research 12, 176-9 (1952) Mar.

Preliminary studies of universal reactions before and after irradiation of patients with polycythemia vera led to the following results. In the patients in whom the universal reactions showed a rise in precipitation following irradiation, the polycythemia was found to be under control. In the patients in whom the universal reactions showed no rise in precipitation following irradiation, the polycythemia was found to be in an active state and not under control.

2814
EFFECT OF BAL ON SURVIVAL OF RATS AFTER LETHAL DOSES OF POLONIUM. John B. Hursh. Proc. Soc. Exptl. Biol. Med. 79, 210-2(1952) Feb.

Control rats injected with a lethal dose of polonium (36 μc/kg) had a median survival time of 22 days, whereas the BAL-treated group had a median survival time of 89 days. Blood studies of control rats showed the typical picture of hemopoietic failure in contrast with well sustained cell and platelet levels found for the BAL-treated group. The difference is believed to be due to a reduced radiation exposure of the spleen and marrow caused by the action of BAL in accelerating excretion and in diverting polonium from the hemopoietic organs into muscle. (auth)

2815
EFFECTS OF HIGH-VOLTAGE CATHODE-RAY IRRADIATION ON COTTONSEED. M. G. Lambou, R. Y. Mayne, B. E. Proctor, and S. A. Goldblith. Science 115, 269-71 (1952) Mar. 7.

Cotton seeds were infected with molds and bacteria and exposed to up to 3,000,000 rep of 3-Mev cathode rays. Significant reduction of the numbers of microorganisms was accomplished without change in moisture or free fatty acid contents, but with increasing inhibition of germination and seedling growth with increasing cathode-ray dosages. The inactivation of one or more enzymes is suggested.

2816
EXPERIMENTAL STUDIES ON EARLY LENS CHANGES AFTER ROENTGEN IRRADIATION. III. EFFECT OF X-

RADIATION ON MITOTIC ACTIVITY AND NUCLEAR FRAG-
MENTATION OF LENS EPITHELIUM IN NORMAL AND
CYSTEINE-TREATED RABBITS. Ludwig Von Sallmann.
Arch. Ophthalmol. (Chicago) 47, 305-20(1952) Mar.

The relative protective action of pretreatment with
cysteine against x-ray damage of the lens was demonstrated
in this study by a lower incidence of nuclear fragmentation
in all zones of cysteine-pretreated eyes as compared with
the incidence of this type of damage in the eyes of untreated
irradiated rabbits and of rabbits treated after irradiation.
(auth)

2817
PROTECTIVE EFFECT OF SMALL LEAD SHIELDS DURING
REPEATED WHOLE-BODY X-RAY IRRADIATION OF RATS.
J. Gershon-Cohen, M. B. Hermel, and I. O. Griffith, Jr.
Radiology 58, 383-9(1952) Mar.

Small lead shields placed over various surfaces of the body
were found to enhance the survival rate of rats exposed to
whole-body x-irradiation. This occurred when the shields
covered only 15 per cent of the exposed body surface. A
second dose of 600 r (LD_{50}) given thirty-four days after the
first dose did not result in any significant decrease in sur-
vival rate, but disturbed nutrition, as evidenced by diminished
weights, was slightly greater after the second exposure.

2818
FURTHER STUDIES ON THE NATURE OF THE HEMOR-
RHAGIC STATE IN RADIATION INJURY. D. P. Jackson,
E. P. Cronkite, G. V. Leroy, and Bernard Halpern. J. Lab.
Clin. Med. 39, 449-61(1952) Mar.

The hemorrhagic state occurring in severe radiation injury
was studied in ten dogs exposed to 600 r of whole-body x
radiation. The occurrence of abnormal coagulation of the
blood, spontaneous purpura and thrombocytopenia were
closely related. No conclusive evidence was found for the
presence of a circulating anticoagulant of the type that could
be detected by Conley's test, or by heparin-protamine titra-
tion tests. Specific tests for antithromboblastins and anti-
thrombins were not performed. It appeared that the clotting
defect, postirradiation, was due to the decrease in the number
of circulating platelets. (auth)

2819
LATE RADIATION NECROSIS OF THE JAW BONES.
Thomas J. Cook. J. Oral Surg. 10, 118-37(1952) Apr.

Late effects on normal mouth tissues of high voltage x
rays used in treatment of cancer of the oral cavity are dis-
cussed. Caustive factors of irradiation osteonecrosis, pro-
phylaxis, treatment, and case histories are reviewed.

2820
STUDIES ON X-RAY INDUCED RECIPROCAL TRANSLO-
CATIONS IN EINKORN WHEATS, IV. AUTOTRIPLOIDS.
Kosuke Yamashita. Japan. J. Genetics 26, 69-72(1951)
Aug.

The cytogenetic behavior of x-ray induced reciprocal
translocations in three cases of triploids from crosses in
Einkorn wheat is described.

2821
BLOOD COAGULATION AND HEMOSTASIS BY SPLEEN
IRRADIATION IN GYNECOLOGY. Helmut Wagner. Arch.
Gynäkol. 181, 246-76(1952) (In German)

A detailed scheme is presented of blood coagulation,
based on observations of 30 women treated for juvenile,
preclimacteric, or cancerous chronic bleeding by x irra-
diation of the spleen.

2822
ULCERATED RADIODERMATITIS OF THE NUCHA.
HEALING OF ULCERATIONS AND PAIN BY PLACENTAL
EXTRACTS. L. Périn and S. Boulle. Bull. soc. franç.
dermatol. syphilig., 415-17(1951) July-Oct. (In French)

A 51-yr-old woman with an extensive and painful ulcer-
ation on the nape of the neck resulting from extensive x-

ray therapy of a cervico-dorsal neurinoma was treated
with a total of 60 daily injections of a placental extract in
three series, and a subcutaneous abdominal placental im-
plant was made. Complete remission was obtained.

RADIATION HAZARDS AND PROTECTION
2823
Atomic Energy Project, Univ. of Rochester
SOME POTENTIAL HAZARDS OF THE WIDESPREAD USE
OF ROENTGEN RAYS IN PEDIATRICS, by Robert W.
Miller. Mar. 13, 1952. 24p. (UR-191)

Experimental work indicating that the young recipient of
x rays is apt to develop late sequelae is reviewed. The
possibility of the alteration of a key physiologic process
and the subsequent development of anomalies, infertility,
carcinomas, premature senility, or degenerative changes
is pointed out. It is suggested that elective pediatric x-ray
procedures be limited as much as possible and that roent-
gen exposure diaries for patients be kept. 50 references.

2824
Naval Radiological Defense Lab.
PROTECTION OF MICE AGAINST X-IRRADIATION BY
SPLEEN HOMOGENATES ADMINISTERED AFTER EX-
POSURE, by L. J. Cole, M. C. Fishler, M. E. Ellis, and
V. P. Bond. Jan. 15, 1952. 18p. (USNRDL-339; U21254)

Preliminary data indicate that mice which receive lethal
doses of total-body x-irradiation are protected by a single
intraperitoneal injection of spleen homogenate administered
between 1 and 45 hr after exposure. Each of 15 mice was
exposed to 700 r and given the equivalent of 1.3 spleens in
the form of phosphate-buffered (pH 7.2) homogenates from
1- to 3-week-old nonirradiated mice. A control group
recieved only phosphate buffer. Of the exposed mice, 14
were alive at 30 days, whereas only 1 out of 10 of the con-
trol group survived. Of 14 other mice exposed to 800 r and
injected with the equivalent of 1.8 spleens each, 11 survived;
all of the control animals died. A quantitative relation may
exist between the amount of spleen substance injected and
the degree of protection obtained. (cf. U19994) (NRS abst.)

RADIOGRAPHY
2825
RADIOGRAPHY OF THE HUMAN BODY WITH RADIO-
ACTIVE ISOTOPES. W. V. Mayneord. Lancet 262, 276-8
(1952) Feb. 9.

The possibility of using low energy γ-emitting radioiso-
topes for radiography of the human body is discussed. Pre-
liminary work using Tm^{170} as a source is described.

RADIOTHERAPY
2826
RADIOACTIVE ISOTOPES IN SURGERY. Campbell Moses,
Penn. Med. J. 55, 140-2(1952) Feb.

The use of radioactive iodine in the evaluation and therapy
of hyperthyroidism and thyroid carcinoma has been briefly
presented. The newer procedures involving the use of radio-
active diiodofluorescein and human plasma protein in the
localization of intracranial neoplasms have been described.
The value of the local administration of radioactive iodine
and collodial gold in the management of intractable pleural
effusion due to metastatic carcinoma has been indicated. The
important but sharply limited value of radioactive isotopes in
medical practice has been emphasized. (auth)

2827
COMPARISON OF DOSE DISTRIBUTIONS IN PATIENTS
TREATED WITH X-RAY BEAMS OF WIDELY DIFFERENT
ENERGIES. Hugh Garrison, John Anderson, John S. Laughlin,
and Roger A. Harvey. Radiology 58, 361-8(1952) Mar.

Dose distributions of high-energy x-ray beams are best
evaluated in terms of tumor dose, integral dose, and average

dose in healthy tissues unavoidably irradiated in the treatment of a neoplasm. Tumor dose itself is not an adequate description of a treatment, since it may vary by as much as 30% in different areas in the same tumor, particularly at lower energies. The variation is usually less than 5% at high-voltage levels such as are attained with the betatron. The total integral dose, though important, is also an inadequate description of the treatment, since its maximum value does not correspond with the best dose distribution. The average dose unavoidably delivered to healthy tissues is an important criterion in the evaluation of radiation treatment on any energy level. The lower this dose is, the fewer the symptoms of radiation sickness the patient will probably experience, and the greater will be the healing of the tumor bed. The 23-Mev betatron x-ray beam produces a more uniform tumor dose in most internal neoplasms, a lower integral dose per tumor dose, and a lower average dose in healthy tissue unaviodably irradiated than does the 400-kv machine. (auth)

2828

THE POSSIBLE USE OF NEUTRON-CAPTURING ISOTOPES SUCH AS BORON[10] IN THE TREATMENT OF NEOPLASMS. I. INTRACRANIAL TUMORS. William H. Sweet and Manucher Javid. J. Neurosurg. 9, 200-9(1952) Mar.

Certain isotopes, such as B^{10}, have a special tendency to capture slow (thermal) neutrons, whereas the atoms normally present in living tissues do not do so. Since B^{10} at capture yields an alpha particle of high energy which travels only about 14μ in tissue, the site of the atom of B^{10} determines the site of destruction of tissue following this capture reaction. Chemical analyses in 58 cases after intravenous injection of borax show that this concentrates in many rapidly growing brain tumors to more than three times the extent that it does in normal brain. This differential is maintained for only the first 20 to 30 minutes after injection in most cases. The total amount of boron that may be introduced without toxic effects yields concentrations in tumor $>50\mu g/g$ and in brain $>15\mu g/g$ of tissue — sufficient, according to our computations, to cause, despite other capture reactions, energy in tumor three times that in normal tissue. A tactic for utilizing these effect to treat brain tumors in man is described. (auth)

2829

INTRODUCTION TO RADIOISOTOPE THERAPY. F. Passalacqua. Farm. sci. e tec. (Pavia) 7, 92-100(1952) Jan.-Feb. (In Italian)

A brief discussion of radioisotope selection, dosage, and toxicology is illustrated by literature data on the tissue distribution and excretion of Po.

2830

FIXATION OF I^{131} IN THE HUMAN FETAL THYROID. CASE HISTORY. U. Marinoni. Folia Endocrinol. (Pisa) 4, 637-40(1951) Oct. (In Italian)

A living fetus, born at the 4th or 5th month of pregnancy, was injected with 30 μc of I^{131}. Significant uptake by the thyroid was found. Appearance of the thyroid tissue is shown. The author advises against the therapeutic use of I^{131} after the 4th month of pregnancy. 5 references.

2831

RADIOISOTOPES (Au^{198}) IN THE TREATMENT OF CERTAIN EPITHELIOMAS IN GYNECOLOGY. J. Magendie, Wangermez, and Blanquet. Bordeaux chir., 139-42(1951) Oct. (In French)

Two case histories of treatment of intestinal epitheliomas with a pectin gel suspension of 2.7-day Au^{198} are reported. Palliative effects were noted. Curves of Au^{198} elimination by the urine are shown.

2832

THERAPEUTIC TEST OF RADIOACTIVE PHOSPHORUS P^{32} IN A CASE OF MYCOSIS FUNGOIDES. J. Gadrat, A.

Bru, and R. Salvador. Bull. soc. franç. dermatol. syphilig., 466-8(1951) July-Oct. (In French)

A 37-yr-old woman with an extensive mycosis fungoides infection of 10-yr duration was treated over 8 months with seven oral doses, ranging from 0.6 to 6 mc, of P^{32}. The doses were well tolerated and improvement was obtained, but the effect was only temporary.

TOXICOLOGY STUDIES

2833

Atomic Energy Project, Univ. of Rochester
THE TOXICITY AND URINARY EXCRETION OF CRYSTALLINE METAPHOSPHATES, by R. E. Gosselin, E. A. Maynard, W. L. Downs, G. J. Miller, H. L. Berke and H. C. Hodge. Mar. 18, 1952. 22p. (UR-192)

In terms of toxicity, hydrolysis, and excretion in rats and rabbits, cyclic polymers of sodium phosphate contrast with linear polymers like crystalline tripolyphosphate and glassy hexametaphosphate. After parenteral administration of the cyclic compounds (sodium trimeta- and tetrametaphosphate), over 90 per cent of the dose is recovered in the urine in an unhydrolyzed state, but a small fraction appears to be broken into orthophosphate residues. In contrast only 10 per cent of sodium tripolyphosphate and about 20 per cent of hexametaphosphate escape hydrolysis in the rat. Calcium salts of these compounds are excreted more slowly, and in consequence hydrolytic destruction is somewhat greater. All hydrolyses observed in vivo are presumably enzymatic. Toxicity offers a second biological distinction between the cyclic and the linear polymers of sodium phosphate. Although none has a high acute toxicity in the rat, the latter are considerably more toxic than the former. This difference is discussed in the light of differences in hydrolysis and excretion. (auth)

2834

OBLITERATING TRACHEITIS, A COMPLICATION FOLLOWING ADMINISTRATION OF RADIOACTIVE IODINE. Ruth Silberberg, Martin Silberberg, and Frank J. Dixon. J. Lab. Clin. Med. 39, 256-9(1952) Feb.

In male mice of strain Dba receiving, at the age of one month, 35 μc of I^{131} per gram body weight, a fatal, obstructive endo- and peritracheitis were observed three to four months after beginning of the treatment. The lesion showed the typical microscopic features of radiation reaction. (auth)

2835

NEPHROPATHY FROM INDUSTRIAL INTOXICANTS. Luigi di Prisco. Ann. igiene 61, 107-206(1951) July-Oct. (In Italian)

A discussion of kidney pathology caused by industrial poisons is followed by separate reviews of toxic effects encountered in the production of Pb, Hg, Al, Sb, As, Be, Cd, Co, Cr, P, In, Os, F, Se, U, Tl, V, and Te.

2836

HISTOLOGICAL AND HISTOCHEMICAL RESEARCHES ON THE ACTIONS OF BERYLLIUM IN VIVO. G. Ninane and R. Pepinster. Compt. rend. soc. biol. 145, 1269-71(1951) Aug. (In French)

The gross changes, alkaline phosphatase inhibition, and mitosis reduction in livers, spleens, kidneys, lungs, intestines, adrenals, and soft bones of 21 guinea pigs injected intraperitoneally, intracardiacally, or subcutaneously with 10 to 150 mg of $BeSO_4$/kg and sacrificed after 24 to 72 hr are described briefly. A multiple mechanism of Be toxicology is suggested.

TRACER APPLICATIONS

2837

Lankenau Hospital Research Inst., Philadelphia
A STUDY OF PRECURSORS OF FORMATE IN THE INTACT RAT, by Sidney Weinhouse and Bernice Friedmann.

Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia. [nd] 15p. (AECU-1949)

An isotopic procedure has been described for detecting formate production in the intact rat. The method consists in administering a labeled substance by intraperitoneal injection, together with unlabeled sodium formate, and measuring the radioactivity of the formate excreted in the urine. The intact rat was found to produce formate from the following substances: α-labeled glycine, glycolate and glyoxylate, β-labeled serine, and methyl-labeled acetone, sarcosine and methionine. Carboxyl-labeled glycine and glycolate, methyl-labeled acetate, and over-all labeled glucose did not yield formate in amounts detectable by the procedure used. (auth)

2838

Naval Medical Research Inst., Bethesda
INFLUENCE OF VITAMIN D ON DEPOSITION OF GALLIUM IN BONE, by H. C. Dudley and Leo Friedman. July 9, 1951. 7p. (NP-3727; Memorandum Report 51-9)

Radiogallium (Ga^{72}) citrate when parenterally injected is deposited in the bones of both normal and rachitic rats. The age and body weight do not significantly affect the uptake of gallium, nor does the oral administration of vitamin D to rats on an adequate diet. Vitamin D orally administered to rachitic rats serves to increase the deposition of gallium in the ends of the long bones (epiphyseal region). Such deposition seems to be a result of normal increased metabolism rather than as a direct result of the vitamin D. Gallium does not seem to offer a reliable indication of vitamin D dosage. (auth)

2839

THE ROLE OF MACROPHAGE MOVEMENTS IN THE TRANSPORT AND ELIMINATION OF INTRAVENOUS THORIUM DIOXIDE IN MICE. Thomas W. Easton. Am. J. Anat. 90, 1-28(1952) Jan.

When Thorotrast was injected intravenously into mice, from $\frac{1}{3}$ to $\frac{1}{2}$ the dose was found to be retained for periods up to a year. The greater part of the loss of ThO_2 from the body was found to take place in the first 10 days. Loss was continued at a slow but constant rate. Subcutaneous injections of CCl_4 after Thorotrast resulted in generally accelerated loss of ThO_2 during approximately 42 days. Macrophages loaded with ThO_2 moved from the red bone marrow, spleen, adrenals, and other abdominal organs into the liver, which contained a progressively higher percentage of the ThO_2 in the body. From the liver, loaded macrophages passed into the circulation to the lungs, from which most of the elimination of ThO_2 occurred. CCl_4 appeared to accelerate all movements of macrophages in the body. Underfeeding appeared to accelerate movements of macrophages from liver and spleen.

2840

METHODOLOGY. Pt.IV of THE RADIOISOTOPE, prepared by Signal Corps. Charles E. Crompton, tech. adviser. 1952. 16 mm film (PMF-5145d). B&W, sound, running time: 40 min.

This film opens with a historical sequence showing the early work of Hevesy in studying plant metabolism with Pb^{212}, illustrating the first criterion one should observe in performing a tracer experiment: radiochemical purity. In succeeding sequences other experiments are shown, each illustrating another criterion. Seven criteria in all are established:

1. Radiochemical purity.
2. Singleness of chemical state.
3. Elimination of exchange error.
4. Knowledge of the degree to which the tagged molecules remain intact.
5. Avoidance of isotope effect.
6. Avoidance of chemical effects.
7. Avoidance of radiation effects.

The concluding sequence shows a research team in key stages of the planning of a tracer experiment (transmethylation in animal metabolism). Three practical considerations are taken into account: a. Economy of time; b. Economy of materials; c. Accuracy desired. This is the first film released of a series on "The Radioisotope" being prepared by the Army Signal Corps, with the technical assistance of the AEC Isotopes Division and AEC contractors, for the Medical Illustration Service of the Armed Forces Institute of Pathology.

2841

INCORPORATION AND TURNOVER OF RADIOPHOSPHORUS IN MOUSE MAMMARY TUMORS (dbrB and C3H). Harry Albaum, Anna Goldfeder, and Lisbeth Eisler. Cancer Research 12, 188-91(1952) Mar.

Studies have been carried out on the incorporation and turnover of radiophosphorus into various fractions derived from the C3H and dbrB mouse mammary tumors, grown in the respective strains of mice. The results indicate again that the dbrB tumor has a higher rate of metabolic activity than the C3H tumor and substantiate those obtained from previous in vitro studies. It is concluded that these mouse mammary adenocarcinomas, although morphologically similar, exhibit significant differences in their physiological behavior. (auth)

2842

AUTORADIOGRAPHIC STUDIES OF CALCIUM, PHOSPHORUS AND STRONTIUM DISTRIBUTION IN THE BONES OF THE GROWING PIG. C. L. Comar, W. E. Lotz, and G. A. Boyd. Am. J. Anat. 90, 113-25(1952) Jan.

The decomposition and removal of Ca^{45}, P^{32}, and Sr^{90} from the skeleton of the weanling pig have been demonstrated using the autoradiographic method. Regions of periosteal origin were characterized by sharp images in the autoradiogram, relatively slow deposition and slow removal. Regions of endochondral origin were characterized by diffuse images, rapid deposition, and rapid removal. Possible explanations in terms of exchange and metabolic functions are presented. An autoradiographic method is presented for the estimation of rate of growth of various parts of the bone. (auth)

2843

RADIOACTIVE PHOSPHORUS IN A PRELIMINARY FIELD STUDY ON PHOSPHORUS UPTAKE BY MAIZE. J. van Garderen, C. F. J. van der Walt and L. H. Stein. S. African J. Sci. 48, 226-31(1952) Feb.

Superphosphate labeled with radiophosphorus was applied broadcast and in-the-row in a preliminary maize fertilizer experiment primarily designed with the object of gaining experience in the tracer technique involved. Of all the phosphorus taken up by the maize plant, only 2 per cent was derived from the fertilizer added as superphosphate. It was found that phosphorus concentrated in the actively growing portions of the plant. Temporary accumulation of phosphorus is suggested to explain a relatively high initial uptake of fertilizer phosphorus in the case of row-placed as against broad-cast superphosphate. (auth)

2844

LOCALIZATION OF BRAIN TUMORS WITH RADIOIODIDE[131] Shelley N. Chou, George E. Moore, and James F. Marvin. Science 115, 119-20(1952) Feb. 1.

A procedure is discussed for the localization of brain tumors by the isotope-encephalometric method using orally administered NaI^{131} followed by a survey with a scintillation counter.

2845

THE DETERMINATION OF THYROIDAL AND RENAL PLASMA I^{131} CLEARANCE RATES AS A ROUTINE DIAGNOSTIC TEST OF THYROID DYSFUNCTION. Solomon A. Berson, Rosalyn S. Yalow, Joseph Sorrentino, and Bernard Roswit. J. Clin. Invest. 31, 141-58(1952) Feb.

A method is described which is suitable for routine diagnostic determinations of thyroidal and renal plasma I^{131} clearance rates and which does not require the analysis of blood samples. The method is based on an observed relationship of relative constancy between the body weight and the space of I^{131} dilution during the first half hour following intravenous administration of the isotope. The clearance rates are readily determined in a single 35-min sitting from the assay of radioactivity in the neck and in a single urine specimen. The relationship of the thyroid I^{131} clearance rate to the rate of thyroid hormone formation is discussed.

2846

THE INCORPORATION OF C^{14} GLYCINE INTO PROTEIN BY HUMAN LIVER SLICES. Charles M. Grossman and James D. Hauschildt. J. Clin. Invest. 31, 192-6(1952) Feb.

The incorporation of carboxyl C^{14}-labeled glycine into the protein of human liver slices has been studied. The specific activities of the protein were higher when the tissue was incubated with Krebs-Henseleit buffer as compared to a KCl-$KHCO_3$ buffer. The reaction was inhibited by nitrogen, cyanide, and failure to add calcium or magnesium. (auth)

2847

THE DISTRIBUTION OF SODIUM AND POTASSIUM IN MAN. Norman Deane and Homer W. Smith. J. Clin. Invest. 31, 197-9(1952) Feb.

Intracellular Na and K have been calculated from simultaneous studies of body water distribution (total body water and extracellular fluid) and total body electrolyte as measured by the isotope dilution technique. The concentration of intracellular electrolyte has been calculated per unit of intracellular water, per unit of cellular mass, and per unit of body solid. The average values for intracellular Na and K concentration in man, as determined in this study, are in close agreement with comparable data obtained from studies in the dog and with estimates of intracellular electrolyte in man. (auth)

2848

EVALUATION OF DIAGNOSTIC METHODS IN DISEASES OF THYROID FUNCTION, WITH PARTICULAR REFERENCE TO RADIOIODINE TRACER TESTS. Bernard Roswit, J. A. Rosenkrantz, J. Sorrentino, R. Yalow, and I. Berlin. Am. J. Med. Sci. 223, 229-38(1952) Mar.

An evaluation is presented of 2 radioiodine tracer techniques: 24-hour I^{131} uptake, and 24-hour I^{131} excretion, as aids to the clinician in the diagnosis and differential diagnosis of diseases of thyroid malfunction in a series of 141 patients. The potentialities and limitations of these 2 radioiodine tracer methods have been discussed. Their diagnostic accuracy has been compared with that of the initial history and physical examination, and of convention laboratory aids, including the basal metabolic rate and the serum cholesterol level. Although the 24-hour I^{131} uptake and excretion tests have been shown to be of invaluable aid to the clinician, and far superior to the basal metabolic rate and serum cholesterol determinations, there still remains an irreducible overlap between euthyroid and hyperthyroid subjects. This overlap appears to be due to extraneous factors and not to biological variations in function of the thyroid gland. There still remains a pressing need for a diagnostic method which will represent a direct measurement of the iodine-accumulating function of the thyroid, independent of extraneous factors such as renal function, and thus reduce the overlap of the euthyroid and hyperthyroid subjects. The thyroid iodine clearance method promises to circumvent these difficulties. A consideration of safe dosage factors has been included. (auth)

2849

THE METABOLISM OF RADIOACTIVE IODINE (I^{131}) IN PATIENTS WITH CARDIAC DISEASE. F. Ross Birkhill, K.

E. Corrigan, and H. S. Hayden. Am. J. Roentgenol. Radium Therapy Nucl. Med. 67, 42-50(1950) Jan.

The metabolism of I^{131} in twenty patients suffering from severe cardiac disease has been studied. Of this group, fourteen subjects had gross evidence of cardiac failure, while the remaining six showed no definite clinical edema at the time of study. The results in this group have been compared with those obtained in a series of patients showing no significant cardiac disease, but having varying levels of total thyroid function as judged by total urinary I^{131} excretion. Results of this work indicate that certain characteristic abnormalities of I^{131} metabolism obtain in patients with cardiac decompensation. These include marked soft tissue retention of I^{131} from twenty-four to thirty-six hours after ingestion of the material together with deficient I^{131} concentration in the thyroid gland during this time. In addition, certain changes in the pattern of urinary I^{131} excretion throughout the period are noted. Attention is called to the fact that these changes in the metabolism of I^{131} may on occasion mask the presence of latent thyrotoxicosis in a patient with cardiac disease. In still other situations, the existence of occult edema as a harbinger of gross cardiac decompensation may be detected by I^{131} tracer study before characteristic prodromal signs and symptoms become evident clinically. (auth)

2850

A RESPIRATION APPARATUS FOR C^{14} STUDIES WITH COWS. Max Kleiber and Melvin Edick. J. Animal Sci. 11, 61-71(1952) Feb.

An apparatus is described which allows the simultaneous measurements of the metabolic rate and the radioactivity in the expired CO_2 of cows injected with C^{14}-labeled compounds over a period of several hours. The operation of the apparatus and the calculation of the results, as rate of CO_2 production and specific radioactivity of the expired CO_2 are illustrated by a trial with injection of carbonate labeled with radioactive carbon. (auth)

2851

APPLICATION OF ^{42}K LABELLED RED CORPUSCLES IN BLOOD VOLUME MEASUREMENTS. G. Hevesy and G. Nylin. Acta Physiol. Scand. 24, 285-91(1952) Feb.

Red corpuscles were labeled by adding $K^{42}Cl$ to a blood sample kept at 37°C for 2 hr. When reinjecting the blood sample to the patient in the course of 1 hr, within the error of the blood volume determination which is 3%, no change in the activity of the red corpuscles could be observed. Washed labeled red corpuscles injected into the circulation lost in the average 3.5% of their K^{42} content in the course of the first hr, while the mean loss per hour in the course of 24 hr was found to be 2.1%. (auth)

2852

DETECTION OF INTRAOCULAR TUMORS WITH RADIOACTIVE PHOSPHORUS; A PRELIMINARY REPORT WITH SPECIAL REFERENCE TO DIFFERENTIATION OF THE CAUSE OF RETINAL SEPARATION. Charles I. Thomas, Jack S. Krohmer, and John P. Storaasli. Arch. Ophtalmol. (Chicago) 47, 276-86(1952) Mar.

With recognition of the importance of localization of brain tumors by means of radioactive isotopes, we have applied this principle to similar localization of intraocular tumors as a diagnostic test in questionable cases presenting retinal detachment. The method of localization is outlined, along with the technique of determinations of radioactivity in vivo and in vitro. Radioautographs are used to illustrate photographically the concentration of radioactive material. The case histories reported include two in which the results of the test were negative, thus demonstrating the importance of this test in the evaluation of the cause of retinal separation. These studies, which must as yet be considered pre-

liminary, thus provide strongly presumptive evidence that the identification of intraocular tumors may be enhanced by the use of P^{32}. (auth)

2853

A COMPARISON OF RADIOACTIVE AND METABOLIC METHODS OF INVESTIGATING THYROID FUNCTION. J. B. Foote, D. H. Mackenzie, and N. F. Maclagan. Lancet 262, 486-8(1952) Mar. 8.

The correlation between the B.M.R. and a radioiodine test of thyroid function (thigh-neck clearance) has been examined in 9 normal people and 162 patients with various diseases of the thyroid gland. In untreated people the two tests were strongly correlated (correlation coefficient = +0.76). There was a striking lack of correlation in patients receiving iodine, thyroid, or thiouracil-type drugs. The radioactive test gives anomalous results in patients so treated. Some further results are presented on the thigh-neck clearance test in thyroid disease and they confirm an earlier opinion of its diagnostic usefulness. In the lower ranges of thyroid function the results suggest an all-or-none response by the gland. (auth)

2854

THE DEPOSITION OF TRANSFUSED LYMPHOCYTES, LABELLED WITH RADIOACTIVE PHOSPHORUS. Karl-Erik Fichtelius. Acta Soc. Med. Upsaliensis 56, 225-31 (1951)

Rabbits and rats were injected with large doses of radioactive phosphorus, following which a suspension of lymphocytes was isolated from the thymus of the animals. The labelled rabbit-lymphocytes were transfused to rats (heterotransfusion) and the rat-lymphocytes were transfused to other rats of the same litter, from which the labelled lymphocytes were taken (syngenesiotransfusion). After 24 hours the animals were killed, and the distribution of radioactive desoxyribose nucleic acid phosphorus in thymus, spleen, lymph nodes, bone marrow, liver, lungs and the mucous membrane of the small intestine in the cases of syngenesio- and hetero-transfusion, was compared. The relative radioactivity of desoxyribose nucleic acid phosphorus was somewhat higher in the rabbit-rat-than in the rat-rat-experiment in all organs except the spleen. Here, on the other hand, the activity was higher in the rat-rat experiment. This comparison indicates that the lymphocytes, in the case of syngenesiotransfusion, have not been received as entirely foreign lymphocytes, and that they have to a large extent been retained in the spleen. Two other recently-published experiments using transfusion of lymphocytes with the same object in view are discussed, and compared with this experiment. (auth)

CHEMISTRY

2855

Brookhaven National Lab.
NON-EXCHANGE OF OXYGEN BETWEEN WATER AND SOME COMPOUNDS OF NITROGEN, by Francis Bonner and Jacob Bigeleisen. [nd] 3p. (BNL-1143)

Nitrogen oxide was shaken with O^{18}-enriched water for 40 hr at 22°C. In one experiment the water was strongly alkaline, in another acid. No enrichment in the O^{18} content of the N_2O was detectable with a Consolidated-Nier "Isotope Ratio" mass spectrometer. Five experiments were carried out in which $Na_2N_2O_2$ was decomposed in 1.5% H_2O^{18} solution at initial pH's ranging from 0.05 to 10.6. No appreciable O^{18} enrichment was found in the resultant purified N_2O. Three experiments were carried out in which $Na_2N_2O_3$

dissolved in 1.5% H_2O^{18} was decomposed under conditions such that the predominant products were NO_2^- and N_2O; in none of these was appreciable O^{18} enrichment observed in the N_2O.

2856

Los Alamos Scientific Lab.
PHASE DIAGRAM OF DILUTE SOLUTIONS OF He^3 IN He^4 BELOW THE LAMBDA POINT, by H. S. Sommers, Jr. [nd] 54p. (AECU-1953; LADC-1150)

Phase diagrams of dilute solutions of He^3 in He^4 below the lambda point are given. Measurements of the He^3 distribution were obtained by a modification of the absolute method. The method and apparatus for the experiment are described in detail. Extensive tables of the vapor pressure for various He^3 concentrations are also given. (cf. AECU-1288; NSA 5-3342)

2857

Connecticut Univ.
REPORT ON DISTRIBUTION STUDIES BETWEEN MELTS AND SOLID PHASES USING RADIOACTIVE TRACERS, by J. J. Casey, John Looby, and Roland Ward. Feb. 29, 1952. 27p. (NYO-3276)

The distribution of Ce^{+3} between melts and solid phases at 1000°C has been studied using radiocerium as a tracer. Barium chloride has been used as the melt; barium zirconate and barium titanate have been used as solid phases. A high temperature filteration technique has facilitated the study. The concentration of Ce^{+3} with respect to the zirconate or titanate has varied from about 10^{-13} to about 18 mole percent. The Ce^{+3} has been introduced as $CeCl_3$. In all cases, after equilibration at 1000°C, the Ce^{+3} has been found to be present almost entirely in the solid phases. The residues obtained from experiments from which radiocerium was withheld have been studied by x-ray technique. Powder diffraction patterns have shown the solid phases to be only slightly affected by Ce^{+3} in low concentration. At higher concentrations, the Ce^{+3} causes a breakdown of the barium zirconate and barium titanate lattices, and the patterns of titania and zirconia appear in the powder diagrams. Several possible mechanisms for the initial attack on the solid phase are proposed, and possible methods of approach for determining their validity are outlined. (auth)

2858

Illinois Inst. of Tech.
THE FUNDAMENTAL MECHANISMS FOR THE DECOMPOSITION OF ORGANIC MOLECULES BY METAL-PHOTOSENSITIZATION AND OTHER COLLISIONS OF THE SECOND KIND; PROGRESS REPORT FOR THE PERIOD JULY 1, 1949 TO FEBRUARY 28, 1950, by Harry E. Gunning. Mar. 1, 1950. 84p. (AECU-1950)

The Hg-photosensitized decomposition of cyclopropane, cyclopentane, methylcyclopentane, and cyclohexane has been studied in static systems at 30°C with Hg $6(^3P_1)$ atoms. In each case a linear pressure decrease was observed. A reaction scheme proposed for cyclopentane explains the production of H_2, cyclopentene, and cyclopentylpentane. A liquid polymer $(CH_2)_{3n}$ was the only product found in the cyclopropane reaction. Studies of the rate of decomposition of cyclopropane in cyclopropane-CO_2 mixtures seemed to indicate an inhibiting effect due to CO_2. Hydrogen has been found to be a product of both the methylcyclopentane and cyclohexane reactions. The fraction condensable in liquid N_2 has not been identified definitely. Methods for synthesis of cyclobutane are discussed. The reaction of methylamine with Hg $6(^3P_1)$ atoms was pressure-increasing. The products not condensable in liquid N_2 were 92% H_2 and 8% CH_4 and N_2. The only condensable product identified was NH_3. The reaction between N_2 and H_2 initiated by Hg $7(^3S_1)$ and Hg $6(^3D_1)$ atoms was investigated; no appreciable reaction was ob-

served. A Hg-A resonance lamp fabricated from quartz was
designed to provide an adequate source of 1849A radiation.
With this lamp under optimum conditions 2.7 mg of hydrazine
per hour was produced by photolysis of NH_3 at a flow rate
of 10.5 ft^3/hr.

2859

Atomic Energy Research Establishment, Harwell, Berks
(England)
THE THERMODYNAMICS OF CATION EXCHANGERS. I.
THE PREDICTION OF EQUILIBRIUM CONSTANTS FROM
OSMOTIC DATA, by E. Glueckauf and J. F. Duncan. 1951.
32p. (AERE C/R-808)

The theories put forward to explain ion exchange phenom-
ena are examined. It is suggested that a reasonable inter-
pretation of ion exchange can be made by treating the ex-
changer phase as a concentrated aqueous electrolyte. It is
assumed (a) that the energy of the exchanger is a function
of its volume and its composition only and (b) that the
exchanger phase obeys the laws of concentrated electrolyte
solutions so far as these are known. The water uptake of
polystyrene-sulphonates of different degrees of cross-
linking has been investigated for various monovalent cations.
The data indicate that the anions do not contribute toward
the statistical entropy terms of the solution, and that the
osmotic coefficients of the monovalent cations have trends
similar to those of strong 1:1 electrolytes. An approximate
calculation may be made of the distribution constants of the
exchangers when in contact with solutions containing two
cations. With a few exceptions, the values obtained from
theory are in reasonable agreement with both the absolute
values and the trends observed experimentally for different
ions, different cross-linkages and different solution com-
positions. (auth)

2860

Atomic Energy Research Establishment, Harwell, Berks
(England)
SOME ASPECTS OF THE SOLUTION CHEMISTRY OF ZIR-
CONIUM, by B. A. J. Lister and L. A. McDonald. Oct. 26,
1951. 52p. (AERE-C/R-801)

The report deals with some aspects of the chemistry of
Zr in HNO_3, $HClO_4$, HCl, and H_2SO_4 solutions. A review is
given of our present unsatisfactory state of knowledge of
the species existing in such solutions. Ion exchange tech-
niques have been used to determine the ionic change of
Zr species and the degree of cation-anion interaction to
form complex cations, and to illustrate the presence of
anionic complexes in solution. In addition, the rate of
diffusion from solution into exchangers of different cross-
linking has given information on the ionic size at various
acidities. Other experiments include the measurement of
the rate of self-diffusion in solution, electromigration
studies, pH determinations, and the measurement of titration
curves.

2861

Institute for the Study of Rate Processes, Univ. of Utah.
STUDIES OF PHOTOSYNTHETIC PROCESSES; ENERGY
EXCHANGE IN PHOTO REACTIONS, by Rufus Lumry and
Henry Eyring. July 1, 1951. 81p. (AECU-1943; Technical
Report No. 1)

The history and present knowledge in the general field of
energy exchange are reviewed briefly. An attempt is made
to describe energy-transfer processes of all sorts in terms
of configuration points moving on potential energy surfaces,
not with an idea to absolute calculation utility, but rather as
the best means for general understanding. The processes
discussed include internal conversion processes, diabatic
processes (change in electronic quantum number), chemi-
luminescence, and energy transfer in biological reactions.
231 references.

2862

Bureau of Mines
ELECTRICAL CONDUCTIVITY AND DENSITY OF FUSED
BINARY MIXTURES OF MAGNESIUM CHLORIDE AND
OTHER CHLORIDES, by R. W. Huber, E. V. Potter and H.
W. St. Clair. Mar. 1952. 14p. (BM-RI-4858)

Electrical conductivity measurements were made for five
fused chlorides ($MgCl_2$, $CaCl_2$, $BaCl_2$, KCl, and NaCl) alone
and as binary mixtures with $MgCl_2$. Density measurements
were made of four chlorides ($BaCl_2$, $CaCl_2$, KCl, and NaCl)
alone and as binary mixtures with $MgCl_2$. The measure-
ments of both conductivity and density were made for the
temperature range from the melting point up to 1000°C.
The conductivity and density data are expressed as linear
functions of the temperature, using 800°C as the basing
temperature. The data are tabulated and compared with the
results of other investigators.

2863

INTRAMOLECULAR ISOTOPE EFFECTS IN THE DECAR-
BOXYLATION OF MALONIC ACID. Peter E. Yankwich,
Edward C. Stivers, and Robert F. Nystrom. J. Chem. Phys.
20, 344(1952) Feb.

Malonic acid, singly carboxyl-labeled with C^{14}, was de-
carboxylated at 138°C under 1 atm. of He. Acetic acid and
CO_3 were removed from the gas stream, and acetic acid was
burned to CO_2 which could be analyzed isotopically. Typical
results, expressed as the ratio of rate of rupture of C^{12}—C^{12}
bonds to that of C^{12}—C^{13} and C^{12}—C^{14} bonds, are tabulated.

2864

INFLUENCE OF TEMPERATURE ON THE INTERMOLEC-
ULAR C^{13} ISOTOPE EFFECT IN THE DECARBOXYLATION
OF NORMAL MALONIC ACID. J. G. Lindsay, A. N.
Bourns, and H. G. Thode. Can. J. Chem. 30, 163-5(1952)
Feb.

The intermolecular isotope effect in the decarboxylation
of malonic acid has been found to be constant over the tem-
perature range 137 to 196°C, in agreement with theory
(Bigeleisen, J. Chem. Phys. 17, 675, 998(1949)).

2865

THE ALLOTROPIC TRANSFORMATION OF HAFNIUM AND
A TENTATIVE EQUILIBRIUM DIAGRAM OF THE SYSTEM
ZIRCONIUM-HAFNIUM. J. D. Fast. J. Applied Phys. 23,
350-51(1952) Mar.

The temperature of the transformation in hafnium is at
least 550°C higher than the value 1310 ± 10°C recently re-
ported by Duwez (J. Applied Phys. 22, 1174(1951)). A ten-
tative equilibrium diagram of the system zirconium-hafnium
is given.

2866

REACTIONS OF POLYFLUORO OLEFINS. VI. REACTIONS
OF ALIPHATIC TERTIARY AMINES WITH HEXAFLUORO-
CYCLOBUTENE. Roy L. Pruett, Carl T. Bahner, and
Hilton A. Smith. J. Am. Chem. Soc. 74, 1633-8(1952)
Apr. 5.

Aliphatic tertiary amines have been found to react readily
at room temperature with hexafluorocyclobutene. The initial
quaternary salts obtained were very reactive toward water,
alcohols and primary or secondary amines. Hydrolysis gave
a series of stable compounds which, on the basis of chemical
degradation, method of preparation, and spectral data, are
thought to be trialkyl-(3,3-difluoro-2,4-dioxocyclobutyl)-
ammonium betaines. (auth)

2867

REACTION OF POLYFLUORO OLEFINS. VII. REACTIONS
OF PYRIDINE AND DERIVATIVES WITH HEXAFLUORO-
CYCLOBUTENE. Roy L. Pruett, Carl T. Bahner, and
Hilton A. Smith. J. Am. Chem. Soc. 74, 1638-42(1952) Apr.

Pyridine and four of its derivatives have been found to re-
act with hexafluorocyclobutene at room temperature. The

time required for these reactions varied from several hours to a period of weeks. The betaine type compounds which were produced exclusively in the reaction of aliphatic tertiary amines with this butene followed by hydrolysis were produced only to a small extent when aromatic heterocyclic amines were used. The main product obtained in the latter case varied with the nature of the amine, but in each case where the product was isolable a trimer of hexafluorocyclobutene was produced to some degree. Usually this was the major product. The structural formula of this trimer has been proved and a mechanism is proposed which will account for it. An intermediate in the proposed mechanism has been isolated as the major product in one case. (auth)

2868

REACTION OF POLYFLUORO OLEFINS. VIII. REACTIONS OF HEXAFLUOROCYCLOBUTENE WITH ISOQUINOLINE AND 3-METHYLISOQUINOLINE. Roy L. Pruett Carl T. Bahner and Hilton A. Smith. J. Am. Chem. Soc. 74, 1642-44 (1952) Apr. 5.

Isoquinoline reacted with hexafluorocyclobutene to give a compound sensitive to hydrolysis. The hydrolysis product was stable but could be degraded with acid to (3,3-difluoro-2,4-dioxocyclobutyl)-isoquinolinium betaine. 2-[2-Hepta-fluorocyclobutyl)-2,3,3,4,4-pentafluorocyclobutyl]-isoquinolinium carbeniate was produced as a secondary product 3-Methyl-isoquinoline with this butene gave, after hydrolysis, (3,3-difluoro-2,4-dioxocyclobutyl)-3-methylisoquinolinium betaine, together with an unidentified product. Quinoline did not react with hexafluorocyclobutene. (auth)

2869

STUDIES ON THE ALKALINE EARTH DIURANATES. Henry R. Hoekstra and Joseph J. Katz. J. Am. Chem. Soc. 74, 1683-90(1952) Apr. 5.

Methods for the preparation of the alkaline-earth diuranates have been examined and pure compounds obtained by thermal decomposition of the respective metal-uranyl acetates. The thermal stability of the metal diuranates in vacuum and in the presence of oxygen at temperatures up to 1100° has been investigated by tensimetric methods. The metal diuranate-oxygen systems have been found to be reversible below 1100°. Equilibrium dissociation pressures of oxygen so obtained permit outlining of the diphasic and monophasic regions of composition encountered, calculation of decomposition isotherms and isobars, and the heats of reaction, free energy changes and entropy changes involved. Qualitative studies on rates of oxidation of decomposition products to the diuranates have been made. X-ray investigation of solids of composition MeU_2O_6 indicate the structural similarity of these compounds to uranium dioxide. (auth)

2870

CONDUCTANCES, TRANSFERENCE NUMBERS, AND ACTIVITY COEFFICIENTS OF CHLORIDES OF SOME HIGH ATOMIC NUMBER RARE EARTHS IN AQUEOUS SOLUTION. James Malcolm Wright. Ph.D. Thesis, Iowa State Coll., 1951.

The conductances, transference numbers and activity coefficients of $LaCl_3$, $SmCl_3$, $EuCl_3$, and $YbCl_3$ were determined in order to test the present theories of electrolytic solutions as well as to make available accurate data on these useful properties for these rare-earth chlorides.

2871

LIQUID-SOLID EQUILIBRIA IN THE QUATERNARY SYSTEM $NaCl-KCl-CaCl_2-NaF-KF-CaF_2$, THE THREE CORRESPONDING RECIPROCAL TERNARY SYSTEMS, THE TERNARY SYSTEM OF THE THREE FLUORIDES, AND THE BINARY $KF-CaF_2$ SYSTEM. Mohmmad Ishaque. Bull. soc. chim. France, 127-38(1952) Jan.-Feb. (In French)

Phase diagrams of the fused salt systems making up the $NaCl-KCl-CaCl_2-NaF-KF-CaF_2$ system are presented and discussed. 8 figures.

ANALYTICAL PROCEDURES

2872

[Atomic Energy Research Establishment, Harwell, Berks (England)]

A METHOD FOR THE AMPEROMETRIC TITRATION OF THORIUM, by A. A. Smales and L. Airey. [nd] 6p. (AERE C/M-131)

It was found that amperometric titration technique is applicable to the precipitation of Th by $(NH_4)_2MoO_4$ providing the pH is restricted to the region 2.3 to 2.7. Quantities as low as 1 mg may be titrated with an estimated accuracy of ~10%; by using semimicro cells this value could be improved. In the presence of molar acetic acid, Th may be estimated in the presence of about ten times as much U. The control of pH to 2.5 is essential. (auth)

2873

Geological Survey

A NEW SERIES OF IMMERSION LIQUIDS, by Robert Meyrowitz. Mar. 1952. 9p. (TEM-335)

A new series of high-index immersion liquids (1.66-1.81) has been made. α-bromonaphthalene and a solution of precipitated sulfur (10 percent) in arsenic tribromide are the end members. The mixing curve is not a straight line. After nine months the maximum change in index was -0.001. Stable liquids containing α-bromonaphthalene, arsenic tribromide, precipitated sulfur, and arsenic disulfide are discussed. (auth)

2874

Hanford Works

THE COULOMETRIC DETERMINATION OF URANIUM, by W. N. Carson, Jr. Dec. 3, 1951. Decl. with deletions Mar. 24, 1952. 23p. (AECD-3344; HW-22765)

A coulometric titration method for determination of U depends on use of a Pb reductor to reduce the U to the (IV) valence state, and on electrolytically generated Br in the presence of Fe to oxidize the U to the (VI) valence state. The titration cell and manual titration apparatus are diagramed. The automatic titration apparatus is described in HW-22780. Samples of 0.01 to 7 mg U can be titrated automatically. Interferences with the method are few, and dilutions of $10^{-5}M$ U can be titrated.

2875

INORGANIC CHROMATOGRAPHY ON CELLULOSE. PART VII. THE DETERMINATION OF THORIUM IN MONAZITE AND OF THORIUM AND URANIUM IN URANOTHORIANITE. N. F. Kember. Analyst 77, 78-85(1952) Feb.

A method is described for the quantitative separation of Th from rare earths and other metals; it is based on the extraction of Th nitrate with other containing nitric acid on a column of cellulose. The method has been applied to the determination of Th in monazite sands, and, by means of a double extraction technique, to the determination of U and Th on the same sample of uranothorianite.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2876

Dow Chemical Co.

THE EFFECT OF TEMPERATURE ON THE LATTICE PARAMETERS OF MAGNESIUM ALLOYS, by R. S. Busk. [nd] 9p. (NP-3696)

Lattice parameters and density are tabulated for a series of eight alloys consisting of pure Mg, Mg + Ag, Mg + Al, and Mg + Sn at various temperatures. The main effect of temperature is an increase in the size of the unit cell. The

coefficient of expansion in the temperature range investigated is not affected by alloy additions. The variation of the c/a ratio with temperature and the dependence of the ratio on the electron concentration of the alloy are discussed.

DEUTERIUM AND DEUTERIUM COMPOUNDS

2877

THE REACTION OF ETHYL RADICALS WITH DEUTERIUM. M. H. J. Wijnen and E. W. R. Steacie. J. Chem. Phys. 20, 205-7(1952) Feb.

The reaction of ethyl radicals with deuterium has been studied. The ethyl radicals were produced by photodecomposition of diethyl ketone. Activation energy was found to be $E = 13.3 \pm 0.5$ kcal. From this value it may be concluded that the activation energy is about 11.5 ± 1 kcal for the reaction of ethyl radicals with hydrogen. (auth)

FLUORINE AND FLUORINE COMPOUNDS

2878

Oak Ridge National Lab., Y-12 Area
GENERAL INFORMATION CONCERNING FLUORIDES, by Mary E. Lee. Feb. 19, 1952. 86p. (ORNL-1252)

This report is a compilation of abstracts, taken from Chemical Abstracts (1907 thru Sec. 4, 1952), containing information concerning the fluorides of aluminum, barium, beryllium, calcium, cesium, lead, lithium, magnesium, potassium, rubidium, sodium, strontium, and uranium. (auth)

2879

Washington Univ., St. Louis
STUDIES IN HYDROGEN FLUORIDE (thesis), by Albert William Jache. Feb. 1952. 46p. (NP-3678; U21220)

Studies were carried out to compare the chemical behavior of HF with that of H_2O. Zn and Cu fluorides failed to form ammine complexes or to show amphoteric characteristics in HF; H_2O acting as a base appeared to increase the solubility of FeF_3. EtCl, pentane, methylene chloride, and liquid Cl did not form solid clathrate compounds with HF when added to freshly distilled HF at dry ice temperatures. The latter 2 compounds formed separate layers which might indicate solid HF addition compounds. Cells made in the Kel-F H-tube with saturated Zn and Pb amalgam electrodes and those prepared with Zn and Cd metal and pure Fe and Pb electrodes coated with their metal fluorides were irreversible. None of the electrodes investigated gave reversible or reproducible potentials. Voltage-current curves indicated that high overvoltages are associated with all the electrode processes. In general, the solubilities of the fluorides of metals in HF were similar to the solubilities of the corresponding hydroxides in H_2O and were in the order predicted from the periodic table. Numerous metal fluorides formed solid solvates with HF. When similar compounds were compared, the degree of solvation of the solid phase by HF appeared consistent. (NRS abst.)

2880

INTERMOLECULAR FORCES IN CF_4 AND SF_6. J. S. Rowlinson. J. Chem. Phys. 20, 337(1952) Feb.

The intermolecular forces in CF_4 and SF_6 are calculated. The results are believed to be consistent with the known forces between F atoms. The calculations suggest that one reason for the weakness of the forces between fluorocarbons is the fact that, even for spherically symmetrical molecules, the forces act through points well removed from the centers of the molecules.

2881

DIELECTRIC CONSTANT MEASUREMENTS OF CHLORINE TRIFLUORIDE AT 9400 mc/sec. Dale W. Magnuson. J. Chem. Phys. 20, 229-32(1952) Feb.

The dielectric constant of chlorine trifluoride was determined at 9400 Mc/sec by measuring the change in the resonant frequency of a cavity when it is filled with the vapor. Corrections were made for the amount of dimer formed. The monomer molar polarization was best represented by $P = 15.944 + 1882.0/T°K$ cc and the dipole moment was 0.554 Debye unit. The average dimer molar polarization was found to be 49.8 cc assuming no dipole moment. (auth)

MOLECULAR STRUCTURE

2882

ATTEMPT AT INTERPRETATION OF THE INFRARED SPECTRA OF METALLIC ACETYLACETONATES. Cl. Duval, R. Freymann, and J. Lecomte. Bull. soc. chim. France, 106-13(1952) Jan.-Feb. (In French)

Positions and intensities of the infrared absorption bands of the acetylacetonates of Be, Mg, Al, Sc, Cr, Fe, Co, Cu, Zn, Sm, Th, and U are plotted. The Raman spectra of Be and Zn acetylacetonates also are shown. The absorption maxima are attributed to modes of vibration, and cyclic structures are adopted.

RADIATION CHEMISTRY

2883

THE SUBSTITUTION REACTIONS OF BROMINE ACTIVATED BY NEUTRON CAPTURE. I. STUDY OF THE FORMATION OF BROMINATED DERIVATIVES OF TOLUENE. G. Gavoret and N. Ivanoff. Bull. soc. chim. France, 166-9(1952) Jan.-Feb. (In French)

The relative proportions of the different isomers formed by the direct action of 34-hr Br^{82} neutral atoms and of 18-min Br^{80} ions on toluene were determined. The first reaction was accomplished by exposing C_2H_5Br and toluene simultaneously to slow pile neutrons. Reaction with Br^{80} ions was realized by contacting previously irradiated C_2H_5Br with toluene. The toluene bromide/benzyl bromide ratios were 0.12 and 0.8 for the Br^{82} and Br^{80} reactions, respectively. In both cases the ortho/para/meta ratios were 4/2/1.

2884

THE HOT ATOM CHEMISTRY OF THE PROPYL BROMIDES: EFFECT OF PHASE AND RECOIL ENERGY ON RETENTIONS. Maurice S. Fox and W. F. Libby. J. Chem. Phys. 20, 487-97(1952) Mar.

The yields of the various organic radiobromides formed by neutron irradiation of liquid and solid iso and normal propyl bromides at various temperatures have been determined. Very careful purification of the propyl bromides has given good reproducibility and evidence that the main features of the hot atom chemistry of the propyl bromides have been discovered. The solidification at the melting point results in a threefold or larger increase in yield of certain products, presumably those formed by epithermal bromine atoms, and a smaller increase for the remainder of the products, such as the mother molecule, presumably formed by hot reactions. Isomerization of isopropyl to n-propyl appears to occur with high probability in epithermal reactions. The epithermal production of bromides of considerably higher boiling point than the mother molecule has been confirmed and the phenomenon discussed theoretically. Apparently the retentions in the solid phase depend on energy of the recoil bromine, 36-hr Br^{82} showing 93 percent reten ion in solid n-propyl vs. 80 percent for the 18-min and 4.4-hr Br^{80}'s. This is in contrast to the liquid retentions in which no difference has been observed. On this basis it is concluded that the average recoil energy of the 36-hr Br^{82} is less than those of the two Br^{80} isomers and that the latter two differ relatively little. The theoretical implications of the observed product distributions and the phase effect on these

distributions and the sensitivity to recoil energy are discussed. (auth)

RADIATION EFFECTS

2885

Institute for the Study of Rate Processes, Univ. of Utah
ELECTRODE REACTIONS OF ISOLATED CHLOROPLAST
FRAGMENTS, by H. S. A. Gilmour, Rufus Lumry, and John
D. Spikes. Dec. 1, 1951. 19p. (AECU-1944; Technical
Report No. 3)

Isolated chloroplast fragments from Swiss chard and
from spinach can react reversibly at a platinum electrode.
This reaction is not due to small water-soluble molecules.
A photoreduction of the isolated chloroplast fragments
occurs in oxygen-free suspensions, and may be followed
potentiometrically. Discontinuous oxidative titrations of the
photoreduced chloroplast fragments leads to the conclusion
that two substances capable of slowly reacting with each
other are involved in the photoreduction, but that only one
of these substances reacts at the electrode. The significance
of the rapidly reduced substance as the possible intermediate
locus of reducing power in the Hill reaction is discussed.
(auth)

2886

Institute for the Study of Rate Processes, Univ. of Utah
INHIBITION OF THE PHOTOCHEMICAL ACTIVITY OF
ISOLATED CHLOROPLASTS. I. UNIVALENT IONS, by
John D. Spikes, Rufus Lumry and John S. Rieske. Jan. 15,
1952. 25p. (AECU-1945; Technical Report No. 5)

Univalent inorganic anions are noncompetitive inhibitors
for the photochemical reduction reaction of isolated chard
chloroplasts in the order: $SCN^- > I^- > F^- > NO_3^- > ClO_3^- >$
$Br^- > Cl^-$. The inhibition by anions is attributed to a chemical reaction between the anions and positive groups on the
grana such that the concentration of water available to reaction sites is reduced, or such that the effective concentration of intermediate catalysts is reduced. Univalent inorganic cations appear to be noncompetitive inhibitors
through reactions similar to those of the anions, but competitive with the anions. The order of decreasing
effectiveness of the cations is: $NH_4^+ > Cs^+ > Rb^+ > K^+ >$
$Li^+ > Na^+$. Fluoride ion is an inhibitor of the photochemical
reduction reaction of isolated chard chloroplasts, but gives
a different type of inhibition than the simple behavior observed with the other univalent ions. (auth)

2887

THE SZILARD-CHALMERS PROCESS IN SOLID PHOSPHO-
RUS SALTS. A. H. W. Aten, Jr., H. van der Straaten, and P.
C. Riesebos. Science 115, 267(1952) Mar. 7.

Solid $Na_4P_2O_7 \cdot 10H_2O$, $Na_4P_2O_7$, $Na_2HPO_4 \cdot 2H_2O$, Na_2HPO_4,
and $Na_2HPO_3 \cdot 5H_2O$ were exposed to slow neutrons, then dissolved in water. Distribution of activity among orthophosphate, pyrophosphate, phosphite, and hypophosphite was determined. An appreciable fraction of the total activity was
present as pyrophsophate ions and other ions containing two
P atoms. The responsible process is analogous to formation
of electron pair bonds in organic systems.

2888

CONTRIBUTION TO THE STUDY OF REACTIONS OF
ORGANIC SUBSTANCES IRRADIATED IN VITRO. M.
Ponzio. Radioterapia radiobiol. e fis. med. 6, 242-8
(1951). (In Italian)

The mechanism by which aqueous solutions of succinic,
fumaric, pyruvic, and lactic acids, cystine, cysteine, and
glutathione are transformed by x radiation is discussed
briefly in relation to the biological action of ionizing radiation.

RARE EARTHS AND RARE-EARTH COMPOUNDS

2889

LANTHANON COMPLEXES WITH ETHYLENEDIAMINE-
TETRA-ACETIC ACID. PART II. R. C. Vickery. J. Chem.
Soc., 421-5(1952)

Complexes of the ammonium salt of enta, ethylenediamine-
NNN'N'-tetraacetic acid, with some members of the lanthanon series have been studied spectrophotometrically.
Earlier work on these complexes has been extended, and the
"internal" Stark effect splitting of the absorption spectra is
shown to occur only with neodymium and erbium. Consideration is given to the suggestion that this phenomenon is due
to a perturbation of the lanthanide ionic field, and this hypothesis is recast on the basis of lanthanide paramagnetism
Spectrophotometric data on the neodymium nitrilotriacetic
acid (trilo) complex also are presented. (auth)

SEPARATION PROCEDURES

2890

Atomic Energy Research Establishment, Harwell, Berks
(England)
THE CHEMICAL MANIPULATION OF 200-GRAM AMOUNTS
OF IRRADIATED THALLIUM AT THE ACTIVITY LEVEL OF
ABOUT 5 CURIES OF Tl^{204}; THE REACTION $Tl^{203}(n,p)Hg^{203}$,
by W. J. Arrol, J. Chadwick, and J. Eakins. Mar. 7, 1952.
9p. (AERE I/M-16)

Cans containing about 260 grams of thallous nitrate were
irradiated for about 3 years; the resulting activity per can
was about 5 c of Tl^{204}. The procedure for separating the
Tl^{204} and packaging about 2 c of the Tl^{204} as thallous sulphate
in slightly acid solution and about 3 c as thallous hydroxide
in concentrated solution is given.

2891

A NEW TYPE OF ION-EXCHANGE COLUMN FOR THE
SEPARATION OF RADIOACTIVE BROMINE OR CHLORINE.
E. Berne. Acta Chem. Scand. 5, 1260-6(1951).

An investigation is reported in the development of a suitable method for the separation of highly radioactive Br or
Cl from bromate or chlorate. The best method now considered consists of the use of an ion-exchange column using
silver oxide adsorbed on diatomaceous earth. Equations
for the calculation of the adsorption column setup are
given.

2892

CHEMISTRY OF TECHNETIUM. II. PREPARATION OF
TECHNETIUM METAL. J. W. Cobble, C. M. Nelson, G. W.
Parker, W. T. Smith, Jr., and G. E. Boyd. J. Am. Chem.
Soc. 74, 1852(1952) Apr. 5.

A process for the preparation of fractional gram quantities
of Tc is outlined. A tetraphenylarsonium perchlorate process
precipitate containing coprecipitated pertechnetate was the
starting material. This precipitate was decomposed by
perchloric-sulfuric acid digestion and electrolysis of this
homogeneous solution in concentrated sulfuric acid afforded
a convenient method.

SORPTION PHENOMENA

2893

ADSORPTION OF UX_1 AND RaE BY AN AQUADAG COATED
DIPPING GEIGER-MUELLER TUBE. I. Adler and J.
Steigman. J. Phys. Chem. 56, 493-8(1952) Apr.

A method is proposed for the study of radiocolloids. A
dipping G-M counter is coated with an adsorbent, so that
it serves simultaneously as accumulator and detector. The
method was used to investigate UX_1 (Th^{234}) in aqueous solutions. The increase in counting rate with time was not
noticeably affected by temperature change or different

thicknesses of adsorbent. Linear diffusion was shown to take place. The effect of different acids on UX_1 was examined by this technique. In acid solution there appeared to be an equilibrium between adsorbable and nonadsorbable species. Solutions of carrier-free radiobismuth were studied. The formation of complex ions by chlorides, and the increased adsorption from more acid solution were demonstrated. (auth)

2894

REACTIONS OF IONS IN AQUEOUS SOLUTION WITH GLASS. STUDIES WITH RADIOACTIVE TRACERS. Arthur O. Long and John E. Willard. Ind. Eng. Chem. 44, 916-20(1952) Apr. (cf. AECU-1433; NSA 5-5141)

Various experiments were carried out in an effort to determine whether the sorption of ions from solution by surfaces is a simple ion-exchange process. The following results indicate that the ion-exchange hypothesis is at least incomplete. Glass which has been soaked in 0.2N solutions of H, Ba, or K ions for 330 hr loses Na ions readily when later immersed in water for 10 min. Water is as effective as 0.1N hydrogen ion solution in leaching Na ion from glass. Glass soaked in 6N HCl for 50 hr shows approximately the same ability to sorb Na ion from neutral solutions as does glass soaked in water for 50 hr. Under certain conditions at least, Na ion is lost from glass to a neutral aqueous solution of Na ion faster than it is gained.

SPECTROSCOPY

2895

Johns Hopkins Univ.

THE MOLECULAR SPECTRA OF TRITIUM AND RELATED SPECTRA III; ANNUAL REPORT, by G. H. Dieke. Nov. 1951. 33p. (NYO-693)

A new type of hydrogen microwave discharge tube has made it possible to obtain the T_2 spectrum completely free from TH and H_2. A similar tube filled with a mixture of T_2 and D_2 has made it possible to obtain the TD spectrum under the most favorable conditions. This tube is described in an appendix by G. H. Dieke and S. P. Cunningham. The molecular spectra of all six hydrogen molecules (H_2, DH, TH, D_2, TD, T_2) are now known with considerable detail. The program of wavelength measurements has proceeded without interruption. A preliminary table containing about 24,000 lines, chiefly of T_2 and TH, is now ready. This number will be considerably larger when the plates obtained with the new tubes also have been measured. Wavelength measurements have also been made in the spectra of D_2, H_2, He_2^3, CH, CD, CT, OT. The analysis of the spectra of T_2 and D_2 was greatly extended. After various preliminary trials a beginning has been made with systematic intensity measurements in the spectra of T_2, D_2 and TD. The primary goal is to have data on the response of the relative intensities to changes in discharge conditions. (auth) No tables included.

2896

Radiation Lab., Univ. of Calif.

INFRARED SPECTRA OF BRANCHED LONG-CHAIN FATTY ACIDS, by N. K. Freeman. Mar. 1952. 22p. (UCRL-1721)

The infrared absorption spectra of 27 branched long-chain fatty acids have been studied in an attempt to correlate them with types of chain branching. The observed spectral characteristics which can be associated with specific structural features include some of those previously known for the corresponding branched alkane structures. Various kinds of structural information have been found in the spectra. Branching within 5 carbon atoms of the carboxyl group, and particularly on the α-carbon, can be recognized. Indications may be seen for ethyl and propyl groups, and for two methyl groups on the same carbon atom. Of the latter

type, the isopropyl group is distinguishable. The number of branches (terminal methyl groups) can be determined. The provisional character of this kind of infrared spectral evidence in general must be borne in mind, and specific limitations have been pointed out. Nevertheless, the data presented and the new tentative correlations derived from them should have some usefulness in structural work if further research confirms them and does not reveal too many exceptions. (auth)

2897

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS OF BORON CONTENT OF GRAPHITE AND CARBON. D. Shugar. Bull. centre phys. nucl. univ. libre Bruxelles, Note No. 34 (1952) Jan. 5p. (In English)

A rapid spectrographic method with an accuracy of 30 to 40% for determining B in graphite intended for nuclear purposes is described. Samples containing > 1 ppm B are rejected by arcing directly about 40 to 50 mg of graphite; visibility of the 2497.8 line of B is the rejection criterion. One gram of a passed sample is mixed with an aqueous $Ca(OH)_2$ suspension, which is then evaporated to dryness. Heating at 850 to 900°C for 1.5 hr results in CaO containing the B as Ca borate. Direct arcing of the CaO, with Be as an internal standard and with cupped electrodes, and visual comparison of the intensity of the 2497.8 line with B standards permits estimation of B concentrations as low as 0.2 ppm.

2898

INFRARED ABSORPTION SPECTRA OF FIVE HALOMETHANES. Earle K. Plyler and Nicolo Acquista. J. Research Natl. Bur. Standards 48, 92-7(1952) Jan.

The infrared absorption spectra of five halomethanes, bromodifluoromethane, dibromodifluoromethane, bromochlorodifluoromethane, bromotrifluoromethane, and iodotrifluoromethane have been studied from 2 to 38 microns. Fundamental, combination, overtone, and difference bands have been identified. Many unobserved fundamentals have been predicted by comparisons with related molecules and with Raman spectra. The fundamentals have been classified as to the type of motion and the principal atom involved. Four tables are included to show the relationships among the fundamentals of the molecules compared.

SYNTHESES

2899

Radiation Lab., Univ. of Calif.

PREPARATION OF RADIOACTIVE IODOTRIPHENYL-ETHYLENE, by D. C. Morrison. Mar. 1952. 4p. (UCRL-1719)

Work was undertaken to prepare the iodine analog of the biologically active bromotriphenylethylene, containing I^{131} as a tracer, for work on synthetic estrogens. A detailed method is given for preparation of this radioactive iodotriphenylethylene. The method was an adaptation of that of Koelsch (J. Am. Chem. Soc. 54, 2045(1932)) to a smaller scale with some variations.

2900

ATTEMPTED PREPARATION OF THORIUM(III) FLUORIDE. James C. Warf. J. Am. Chem. Soc. 74, 1864-5 (1952) Apr. 5.

An attempt was made to prepare Th(III) fluoride by the reduction of Th(IV) fluoride by Th metal, following a technique successful in the analogous synthesis of U(III) fluoride. Results indicated that there is no evidence for the existence of a lower fluoride of Th.

2901

MICROCHEMICAL SYNTHESIS OF DERIVATIVES OF BENZACRIDINES LABELED IN THE NUCLEUS WITH C^{14}. P. Daudel, A. Cheutin, M. Flon, N. P. Buu-Hoi, and R. Muxart. Bull. soc. chim. France, 86-9(1952) Jan.-Feb. (In French)

Synthesis of the two angular benzacridines or their meso-substituted derivatives C^{14}-labeled in the nucleus by the condensation of N-arylnaphthylamine with Na acetate in the presence of molten $ZnCl_2$ and HCl is described.

TRANSURANIC ELEMENTS AND COMPOUNDS

2902

Argonne National Lab.

THE CRYSTAL STRUCTURE OF NEPTUNIUM METAL, by W. H. Zachariasen. Jan. 22, 1952. 9p. (ANL-4788)

This report was issued as AECD-3336 and abstracted in Nuclear Science Abstracts as NSA 6-2689.

2903

Radiation Lab., Univ. of Calif.

THE HEAT OF SOLUTION OF NEPTUNIUM METAL AND THE HEATS OF FORMATION OF SOME NEPTUNIUM CHLORIDES. A MICROCALORIMETER FOR HEAT OF SOLUTION MEASUREMENTS, by Edgar F. Westrum, Jr. and LeRoy Eyring. Feb. 7, 1952. 17p. (UCRL-1668)

The heat of reaction of milligram amounts of neptunium metal with $1.5\underline{M}$ HCl containing $0.005\underline{M}$ Na_2SiF_6 was found to be -165.7 ± 0.2 kcal/mole for the apparent molal heats of formation of neptunium (IV) and neptunium (III) in $1.0\underline{M}$ HCl. By comparing the heats of solution of other isomorphous actinide chlorides, those of $NpCl_3$ and $NpCl_4$ are estimated and heats of formation of 216 ± 1 kcal/mole for $NpCl_4$ and 238 ± 1 kcal/mole for $NpCl_4$ are obtained. A convenient precise calorimeter suitable for the determination of heats of relatively rapid reactions for milligram quantities of materials is described and its performance indicated. (auth) (Only slightly different from AECD-2925; NSA 4-6715)

TRITIUM AND TRITIUM COMPOUNDS

2904

THE KINETICS OF THE EXCHANGE OF TRITIUM BETWEEN HYPOPHOSPHOROUS ACID AND WATER. Wilmer A. Jenkins and Don M. Yost. J. Chem. Phys. 20, 538-9 (1952) Mar.

The rates of exchange of tritium between HTO and the two "undissociable" hydrogens of H_3PO_2 were measured. Equations are given for this rate and for the rate of oxidation of H_3PO_2 to H_3PO_3. The results of the experiments verify the presence of two tautomeric forms of H_3PO_2 in aqueous solution.

URANIUM AND URANIUM COMPOUNDS

2905

PREPARATION AND PROPERTIES OF URANYL CARBONATES. I. SODIUM URANYL CARBONATES. Bachelet, Cheylan, Douis, and Goulette. Bull. soc. chim. France, 55-60(1952) Jan.-Feb. (In French)

The reactions of UO_3 with aqueous solutions of Na_2CO_3 and $NaHCO_3$ have been studied. Two new complex compounds, $Na_6[(UO_2)_2(CO_3)_5]$ and $Na_6[(UO_2)_3(UO_2)_2(CO_3)_5]$ were prepared, as well as the known $Na_4[UO_2(CO_3)_3]$. The principal chemical reactions of these carbonates with acids, bases, salts, H_2O_2, etc., their stability to heat, and the formulas of their aqueous complexes were determined.

WASTE DISPOSAL

2906

WASTES CONTAINING RADIOACTIVE ISOTOPES. C. C. Ruchhoft, A. E. Gorman, and C. W. Christenson. Ind. Eng. Chem. 381, 545-9(1952) Mar.

Features of the design and operation of the chemical coagulation and filtration plant at Los Alamos are described.

ENGINEERING

2907

Bureau of Yards and Docks

DESIGN OF PROTECTIVE STRUCTURES (A NEW CONCEPT OF STRUCTURAL BEHAVIOR), by Arsham Amirikian. Aug. 1950. 76p. (NP-3726; NavDocks P-51)

Experimental data and procedures are reported on the blast effects from conventional weapons on different type of structures. The second half of the report discusses the effect of an atomic blast on these same type of structures. An analysis based on a new concept of structural resistance for the design of structures to resist atomic blast is given. This analysis should aid the structural engineer in designing military and civilian protective structures.

AEROSOLS

2908

THE MASS CONCENTRATION OF AIR-BORNE DUSTS; USE OF DIMETHYLTEREPHTHALATE AS A FILTER BASE IN ITS DETERMINATION. P. F. Holt. Metallurgia 45, 156-7 (1952) Mar.

Dimethylterephthalate proved to be satisfactory as a volatile filter base for determination of the mass concentration of dusts. Filter pads made from it showed no signs of disintegration after prolonged running. It is transferred to the filter holder in crystalline form and compressed. It sublimes rapidly under reduced pressure at about 105 to 110°C, leaving the collected material. It is unaffected by moist atmospheres, since it is insoluble in water and non-hygroscopic.

HEAT TRANSFER AND FLUID FLOW

2909

Columbia Univ.

MASS TRANSFER IN LIQUID METAL AND FUSED SALT SYSTEMS; THIRD QUARTERLY PROGRESS REPORT, by Charles F. Bonilla, Bernard Gross, Fred Kant, R. N. Roy-Choudhury, and N. S. Shaikhmahmud. Mar. 1, 1952. (NYO-3088)

A detailed diagram is presented of the recently completed equipment for measuring mass transfer between two liquid metals in a spray column; the first series of runs is outlined. Brief descriptions of the apparatus, procedure, and results of the first run are given for studies of mass transfer between a packed bed (Pb shot) and a liquid metal (Hg). The experimental results of Samarin and Shvartsman (Izvest. Akad. Nauk SSSR Otdel. Tekh. Nauk, 1649-51(1927)) on the diffusivity of various metals in Hg are tabulated; the calculated values have been recomputed, and the ratios of experimental to calculated values are given. The agreement is quite good for the alkali and alkaline-earth metals, but for the other metals the Stokes-Einstein equation prediction is only about half of the observed diffusivity. Results of a literature survey on velocity of droplets in a spray column are summarized for streamline and turbulent flow.

2910

Brooklyn Polytechnic Inst.

A THEORETICAL INVESTIGATION OF THE TEMPERATURE FIELD IN THE LAMINAR BOUNDARY LAYER ON A POROUS FLAT PLATE WITH FLUID INJECTION, by Shao Wen Yuan. Sept. 5, 1947. 26p. (NP-3700; Technical Report No. 4)

2911

BERNOULLI'S THEOREM FOR VISCOUS FLUIDS. J. J. van Deemter. Phys. Rev. 85, 1049(1952) Mar. 15.

The derivation by Madelung (Ann. Physik 43, 417(1943)) of Bernoulli's theorem for viscous fluid, which was confined to steady flow and neglected extraneous forces and heat conductivity, is extended to any motion of a general viscous fluid. Equations for the cases of steady flow of a perfect gas and of an incompressible fluid show that the classical Bernoulli "constant" alters along a streamline because of the flow of heat by conduction and the flow of dynamical energy caused by viscous forces and that the Prandtl number plays a part in heat effects in flowing gases.

2912

AN A-C INDUCTION FLOW METER. W. G. James. Instruments 25, 473-8(1952) Apr.

The theory of the induction flow meter is discussed. A particular design is described in detail; diagrams of component arrangement and the circuits involved are included. Results indicate that this design is practical for the range 0 to 50 ml/min providing the liquid conductivity is at least as great as that of tap water. For such liquids, one can expect a linearity of ±0.25 ml/min and a stability of ±0.5 ml/min if the supply is well regulated.

MATERIALS TESTING

2913

Little, Arthur D., Inc.
INVESTIGATION OF STACK GAS FILTERING REQUIREMENTS AND DEVELOPMENT OF SUITABLE FILTERS; SUMMARY REPORT. Issued June 30, 1951. 48p. (NYO-1575)

Air filters and media suitable for use in AEC laboratories and operating areas were investigated. Pile ventilation studies, atmospheric dust studies, an economic study of capillary air washers versus dry filters for radioactive laboratories, sampling surveys at various points in experimental air cleaning layouts, and evaluation studies of high speed impactors as a practical means of rating efficiency of filters on atmospheric dust are discussed. Development is reported of high efficiency filters for use where air temperatures are moderate. These filters are now in production. Preliminary work is reported to be well advanced on filters for high temperature work or for filtering air containing chemical fumes or mists, where glass media must replace cellulose.

2914

[Atomic Energy Research Establishment, Harwell, Berks] (England)
INDENTATION CREEP OF COMMERCIALLY PURE ALUMINIUM, by K. G. Robinson. [nd] 17p. (AERE M/R-837)

The indentation creep test described in this report was used to examine commercially pure aluminum sheet. A one-inch-diameter steel ball is applied to the sample under a constant load and at a controlled temperature. At the end of the test period the sample is cooled to room temperature and the diameter of the impression measured. Test pieces are examined in this way for various periods of time when the change in diameter of the impression is a measure of the creep. During the course of these tests microscopical examination, chemical analyses, Laue back reflection photographs and hardness tests were made. Tests have been made for periods up to 64 days at 350°C, 41 days at 450°C and 63 days at 500°C. When the diameters of the impressions are plotted against the logarithm of the time a straight line is obtained at each test temperature. This means that the indentation creep rate can be predicted with fair accuracy for considerable periods of time. In addition, the effect on the creep rate of small variations in the chemical composition has been determined. (auth)

2915

[Atomic Energy Research Establishment, Harwell, Berks] (England)
INDENTATION CREEP OF 99.8% ALUMINIUM, by K. G. Robinson. [nd] 14p. (AERE M/R-839)

A one-inch-diameter steel ball is applied to the sample under a constant load and at a controlled temperature. At the end of the test period the sample is cooled to room temperature and the diameter of the impression measured. Samples have been tested in this way for periods up to ~100 days, the change in diameter of the impression being a measure of the creep under constant compression load (indentation creep). As in the previous series of tests on 99.6% aluminum a linear relation is obtained between the diameter of the impression (d) and the logarithm of the time (t). The results can also be plotted to give log/log linearity corresponding to the formula $d = At^s$ which other investigators have found to apply to other metals. The temperature dependence of the indentation creep of both 99.8% and 99.6% aluminum is covered by the general formula of the type $d = k \exp(-Q/RT_t^s)$. A value of Q (activation energy) of 4.1×10^3 cal/g atom applies to both materials but k for 99.8% aluminum is greater than the comparable constant for 99.6% metal. The structural changes proceeding during the period of the test have been followed by hardness measurements and metallographic examination. Grain growth in 99.8% aluminum is shown to be most marked at temperatures above 480°C in positions remote from the indentation (or stress). Under the indentor grain growth is inhibited. Cracking has been noted in those compression test pieces stressed at 500°C. (auth)

VACUUM SYSTEMS

2916

A VACUUM-EVAPORATION APPARATUS WITH HIGH-VELOCITY PUMPING. René Bernard and François Davoine. Vide, Le 7, 1136-8(1952) Jan. (In French)

A laboratory stand equipped with an oil-diffusion pump, forepump, and controls is described. Evacuation of a bell jar to 10^{-5} mm Hg at the rate of 230 liter/sec is possible. Electrical outlets on the plate supporting the bell jar permit a wide variety of vacuum-evaporation activities.

2917

AN INTRODUCTION TO HIGH VACUA IN NUCLEAR PHYSICS. A. S. Baxter. Vacuum 1, 185-190(1951) July.

In this introductory article to a series dealing with vacuum techniques as they affect the design and performance of nuclear research, an outline is given of the needs for high vacuums in the study of nuclear physics and the consequent parallel developments within these subjects. The nature of nuclear reactions and the vacuum requirements of associated instruments is also briefly described.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

2918

Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS, by F. H. Norton, W. D. Kingery, et al. Apr. 1, 1952. (NYO-602)

Thermal conductivity of titania, mullite, and zircon have been measured in the range from 200 to 1400°C by the

ellipsoid envelope method. Measurement of conductivity of Al_2O_3, BeO, and MgO has been extended to 1800°C by employing inductive heating. All these materials showed an increase in thermal conductivity above ~1500°C which is believed due to the effect of radiant transmission by the translucent specimens. A new derivation of the heat flow equations for ellipsoidal specimens and calculations of the effect of porosity are presented. The thermal conductivity of Al_2O_3, BeO, and MgO over the entire temperature range from room temperature to 1800°C is analyzed and the effects of radiation and translucency considered. (auth)

2919

FUSED STABILIZED ZIRCONIA AND REFRACTORIES. O. J. Whittemore, Jr., and D. W. Marshall. J. Am. Ceram. Soc. 35, 85-9(1952) Apr.

Production of fused stabilized zirconia directly from ores in an electric arc fusion furnace is described. By this method, stabilized zirconia containing as low as 0.19% SiO_2 has been made in one furnacing from an ore containing 33% SiO_2. Refractories of this material have been used at temperatures up to 2550°C. They possess low thermal conductivity, low electrical resistivity, low reactivity with various substances, and relatively good thermal shock resistances.

CORROSION

2920

[Metals Corrosion Lab., Bureau of Mines]
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; SEMIANNUAL REPORT FOR JUNE 1951, by L. B. Golden, I. R. Lane, Jr., J. T. Pons, W. R. Acherman, and W. Mace. [nd] 41p. (NP-3747)

Tests have been made on the corrosion resistance of Zr and Zr alloys in HCl (embrittlement tests), H_2SO_4 and H_3PO_4. A comparison was made of the relative corrosion resistance of low-Hf arc-melted Zr and Zr containing less than 3% Hf induction-melted in graphite. A series of Zr alloys was subjected to tests in various rocket fuels and synthetic ocean water spray. Corrosion rates were determined for Zr and stainless steel in aqua regia. Ti, Zr, and stainless steel were also tested in NH_4Cl solutions and boiling synthetic ocean water. Ti and Pb were exposed to H_2SO_4 and HNO_3 acid mixtures. Galvanic corrosion tests were conducted on Ti coupled with Mg, Zn, Al, Pb, Sn, Ni, and Cu. Galvanic potentials and corrosion rates were determined in synthetic ocean water, 1% HCl, and 1% NaOH solutions. Solution potentials were determined in substitute ocean under different conditions of aeration. Open circuit potentials were determined and the potential of each metal relative to the saturated calomel half-cell was recorded for Mg, Sn, and Ni coupled with Ti.

2921

Metals Corrosion Lab., Bureau of Mines
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; SEMIANNUAL REPORT FOR JULY-DECEMBER 1951, by L. B. Golden, D. Schlain, I. R. Lane, Jr., W. L. Acherman, and W. Mace. [nd] 47p. (NP-3748)

Corrosion data have been obtained for Ti, Zr, and stainless steel in various concentrations of H_2SO_4, HNO_3, HCl, and H_3PO_4. The effect of mixed acid solutions on Zr was determined. Ti, Zr, and stainless steel were also tested in inorganic chlorides, hypochlorite solutions, and organic compounds. Embrittlement tests in concentrated HCl under pressure were made on Zr-Sn alloys. Zr-Ti alloys (induction melted in graphite) were exposed to the corrosive action of H_3PO_4, HCl, and H_2SO_4. The corrosion resistance of arc melted Zr-Ti alloys was determined in cupric and ferric chloride solutions and in aqua regia. A series of Zr alloys was subjected to tests in various rocket fuels. The com-

plete resistance of all these alloys to attack by anhydrous hydrazine was of special interest. Galvanic couple tests and electrode potential measurements involving Ti in synthetic ocean water and 0.1N HCl and Zr in synthetic ocean water indicates that these metals are electropositive (noble) with respect to certain common metals. Cu, Al, Sn, Pb, Mg, and Zn undergo rapid galvanic corrosion, Cu and monel are attacked moderately, and Ni corrodes very slowly. Mg coupled with Zr in synthetic ocean water is rapidly consumed by galvanic action. Although Ti and Zr show small losses in weight under certain conditions, corrosion rates are always under 1 mil per year.

GEOLOGY AND MINERALOGY

2922

DISCOVERY OF URANIUM IN THE PHOSPHATE BEDS OF MOROCCO. André Lenoble, Henri Salvan, and Valéry Ziegler. Compt. rend. 234, 976-7(1952) Feb. 25. (In French)

The observations of various authors on the β and γ activity in the phosphate basins of French Morocco are recounted briefly. It is concluded that the radioactivity is associated exclusively with the phosphate deposits and that the intensity increases with the age of the deposit. Analysis proved the radioactivity to be that of U.

2923

SHIPROCK URANIUM SAMPLER. G. R. Kennedy. Eng. Mining J. 153, 86-8(1952) Apr.

The engineering highlights of the new U sampling plant near Shiprock, N. Mexico, are discussed. A diagram of the plant, a flowsheet, and six photographs are included.

METALS AND METALLURGY

2924

Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES, by F. H. Norton and W. D. Kingery, et al. Apr. 1, 1952. (NYO-3139)

A review of the literature pertaining to carbide, nitride, and sulfide reactions with metals has been completed. Samples of nitrides and carbides have been prepared for use in reaction and surface tension studies. Surface tension and wettability data for iron, nickel, and silicon on ceramic oxides have been reviewed and the results are summarized. Additional improvements and tests of a microscopic furnace for sintering studies have been completed and spherical particles of aluminum and zirconia prepared. (auth)

2925

Atomic Energy Research Establishment, Harwell, Berks (England)
EFFECTS ASSOCIATED WITH THE FLOW OF VACANCIES IN INTERMETALLIC DIFFUSION, by R. S. Barnes. Jan. 1, 1952. 25p. (AERE M/R-843)

Experiments on the interdiffusion of copper-alpha brass and copper-nickel couples and sandwiches, have shown that there is an increase of volume in the diffusion zone as a result of diffusion. This increase in volume is associated with the formation of voids with crystallographic faces. These voids appear near to the original interface and on that side from which there is a net loss of atoms or a net gain of vacancies, as shown by the movement of inert markers. Grain boundaries influence the movement of the markers in regions where there has been preferential grain-boundary diffusion. A close micrographical examination of the diffusion zone shows it to have an unusual structure, various observations pointing to the presence of strain. X-ray back-reflection photographs of a copper-nickel couple show that the diffusion zone is polygonized.

Subsidiary experiments suggest how strain in the diffusion zone arises. A vacancy mechanism of diffusion where there is a preferential flow of vacancies in the one direction, is used to explain the above phenomena. This flow will cause a state of strain in the diffusion zone if vacancies are generated on one side of the original interface and collapse on the other. Mechanisms are discussed for the generation and condensation, within the diffusion zone, of the large numbers of vacancies necessary for the process. To explain the volume increase and formation of voids it is postulated that not all the vacancies on the one side of the interface are eliminated by the lattice collapsing, but that some vacancies coalesce to form microscopic voids which enlarge by absorbing further vacancies. (auth)

2926

Armour Research Foundation
DEVELOPMENT OF PROTECTIVE COATING FOR TITA-NIUM AND TITANIUM ALLOYS; INTERIM TECHNICAL REPORT NO. 2, OCTOBER 1, 1951-JANUARY 31, 1952, by William H. Colner, Morris Feinleib and Howard T. Francis. [nd] 11p. (NP-3688; Interim Technical Report No. 2; U21434)

The method developed for obtaining adherent Cu coatings on Ti by electrodeposition utilizes a Zn strike (at 3 to 4 min and a current density of 35 amp/ft^2) from a bath containing HF and ethylene glycol before the Cu plating. Fairly consistent 0.0005-in.-thick plates were obtained; 0.005-in. plates were not as adherent. Time and current density of the strike bath affected the quality of the coating. Freshly prepared baths often gave more adherent electroplates. Nonadherent plates were obtained with baths based on dioxane or consisting of ZnO in HBF$_4$ (with or without HF), highly alkaline ZnO solutions, or a solution of ZnCl$_2$ in concentrated H$_2$SO$_4$ and 60% HF. (NRS abst.)

2927

Metallurgical Project, Mass. Inst. of Tech.
THE ROLE OF METALLURGY IN THE DEVELOPMENT OF ATOMIC POWER, by A. R. Kaufmann. Feb. 15, 1952. Decl. with deletions Mar. 3, 1952. 17p. (AECD-3340; MIT-1084)

A discussion is presented covering in general terms some of the metallurgical problems in the atomic power industry. Neutron economy, critical mass, moderators, fuel elements, reactor cooling and radiation damage are the main topics covered.

2928

[Massachusetts Inst. of Tech.]
OBSERVATIONS OF CREEP OF THE GRAIN BOUNDARY IN HIGH PURITY ALUMINUM, by Hsing Chien Chang and Nicholas J. Grant. [nd] 21p. (NP-3697)

The following conclusions can be drawn from constant load creep experiments on very coarse-grained high-purity aluminum at 700°F under a stress of 85 psi: (1) Successively alternating boundary slip and migration and the resultant deformation in the grains caused by the above process are the salient features of creep at elevated temperatures. (2) A creep curve obtained between two reference marks across a grain boundary which undergoes successive slip and migration shows several cycles of ''active boundary slip'' and ''boundary migration.'' This behavior is supported by optical observations during the actual creep test. (3) Etch pits, scratches and needle indentations on the grain surface exert a strong influence on the course of boundary migration, mainly as attracting effect. Surface energy around the irregularity is suggested to be a very important factor in this phenomenon. (4) The effect of grain boundary slip is by no means restricted to a thin layer in the vicinity of grain boundary, but rather extends to a large volume along both sides of the heavily slipped boundary. (5) Two types of de-

formation in the grains caused by boundary slip were observed, i.e., fold formation and sub-grains. Lattice bending is believed to play an important role in both forms of deformation. (auth)

2929

Metallurgical Project, Mass. Inst. of Tech.
SOME PROPERTIES OF HIGH-PURITY ZIRCONIUM AND DILUTE ALLOYS WITH OXYGEN, by R. M. Treco. Apr. 1951. Decl. with deletions Apr. 14, 1952. 36p. (AECD-3346; MIT-1056(Rev.))

A systematic investigation of the physical and mechanical properties of dilute alloys of oxygen in high-purity iodide-refined Zr showed that addition of small amounts of oxygen enhances the strength properties and impairs the resistivity and ductility only slightly, but larger amounts produce brittleness. Oxygen alloys have working properties comparable to those of pure Zr. Tensile properties of 0.13 wt. % alloy and pure Zr are compared at temperatures up to 400°C. Strength at elevated temperatures is increased by addition of oxygen. Techniques for producing oxygen-Zr alloys are described in some detail.

2930

Oak Ridge National Lab.
HIGH TEMPERATURE MECHANICAL PROPERTIES OF METALS AND ALLOYS, by G. H. Boss. [nd] 21p. (CF-51-11-72)

Stress rupture, creep strength, and short-time tensile test data, coefficients of expansion, and composition are presented in these tables. The alloys listed include ferrous alloys, Ni alloys, Co alloys, a group of recently developed non-commercial alloys, and valve steels. A group of miscellaneous metals includes Pt, Pd, Mo, W, Zr, Ta, and Nb. 55 references.

2931

Institute of Engineering Research, Univ. of Calif.
EFFECT OF ALLOYING ELEMENTS ON GRAIN BOUNDARY RELAXATION IN ALPHA SOLID SOLUTIONS OF ALUMI-NUM, by C. D. Starr, E. C. Vicars, A. Goldberg and J. E. Dorn. Jan. 1952. 53p. (NP-3670; U21265)

The effects of Mg, Zn, Ag, Cu, and Ge on the grain-boundary relaxation of α-solid solutions in Al were compared by means of the relation, $G/G_u = Z_3\{AD^{1.86}\nu e^{Q/RT}\}$, where G is the shear modulus, G_u the unrelaxed shear modulus, A the composition parameter, D the grain diameter, ν the vibration frequency, Q the activation energy, R a gas constant, and T the absolute temperature. Small additions of Zn, Ag, Cu, and Ge that formed solid solutions failed to significantly affect the resistance to grain-boundary relaxation. The Q value for these alloys and for pure Al was 38,000 cal/mole. For Al-Mg alloys, the Q value increased linearly from 38,000 cal/mole at 0% Mg to 54,000 cal/mole for 1.617 at. % Mg. Additions of Ag and Cu to Al decreased the width of the relaxation band whereas Mg and Ge broadened the band; Zn additions failed to affect the bandwidth. Mg appeared to be the most effective alloying element for restraining grain boundary relaxation. (NRS abst.)

2932

General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; THIRTEENTH QUARTERLY REPORT, by J. H. Hollomon and D. Turnbull. Apr. 5, 1952. 8p. (SO-2020; Progress Report No. 30)

Quantitative data indicate that small additions of Pb ($\sim$1 at. %) to Ag markedly increases the rate of Ag self diffusion, but the activation energy for self-diffusion is little affected by the Pb addition. Activity coefficients have been measured as a function of temperature and composition for Cu-Au and Fe-Ni alloys. The results indicate that Fe and Ni form an ideal solid solution. The heat capacity of

diamond has been accurately measured as a function of temperature between 25 and 300°K. (auth)

2933

Metallurgical Labs., Sylvania Electric Products, Inc.
MECHANICAL PROPERTIES OF TITANIUM; THIRD QUARTERLY PROGRESS REPORT, PART II, MAY 1, 1951 TO AUGUST 1, 1951 (Final Technical Report), by F. D. Rosi, F. C. Perkins, and B. H. Alexander. Issued Feb. 15, 1952. 47p. (NP-3693)

The tensile properties of titanium of commercial purity were investigated in the temperature range 77 to 925°K (−196 to 652°C) at constant strain rates of 0.003 min^{-1} and 0.138 min^{-1}. The results of these tests showed that this material exhibits the usual mechanical effects associated with strain aging. The curves describing the dependence of a number of mechanical properties on temperature indicate that the strain aging is more marked in certain temperature ranges. Some observations were made on the nature of Lüders bands in an extended, coarse-grained sheet specimen. (auth)

2934

Metallurgical Project, Mass. Inst. of Tech.
EFFECT OF SMALL ADDITIONS OF OXYGEN ON LATTICE CONSTANTS OF ZIRCONIUM, by R. M. Treco. Jan. 1952. Decl. Apr. 11, 1952. . 17p. (AECD-3345; MIT-1079)

Precision lattice constants of high-purity (0.026 wt.% O$_2$) Zr were as follows: $a_0 = 3.2256_2 \pm 0.00014$ kx units; $c_0 = 5.1370_9 \pm 0.00036$ kx units. Extrapolated lattice parameter values were also obtained for oxygen-free Zr. X-ray diffraction examination of a series of oxygen alloys of high-purity Zr crystal bar showed a marked expansion of the hexagonal lattice with increasing oxygen. Oxygen is shown to be an active hardening agent in Zr, occupying an interstitial position in solid solution. The effect of minor impurities on density was found to vary with the specific elements. X-ray density of high-purity crystal bar was found to be 6.509 g/cc. A comparison of purity and density of various types of Zr is included.

2935

PRODUCTION OF TITANIUM INGOTS BY MELTING SPONGE METAL IN SMALL INERT-ATMOSPHERE ARC FURNACES. W. E. Kuhn. J. Electrochem. Soc. 99, 89-96 (1952) Mar.

Two laboratory arc furnaces are described in detail. These furnaces were used to make ingots having diameters of 2½, 3, and 5 inches, and weighing up to 6 pounds. Satisfactory melting of titanium sponge in the inert-atmosphere arc furnace using nonconsumable electrodes is limited to sponge low in magnesium chloride, because the presence of entrained chloride causes spattering of the molten titanium onto the electrode tip, and contamination of the melt by the electrode material. Graphite sleeves lining the inside of the water-cooled crucibles of small inert-atmosphere arc furnaces improve the melting efficiency but result in a prohibitively high carbon pickup. The carbon pickup tends to decrease as the diameter of the graphite-lined crucible increases. Alternating current arcs in the inert-atmosphere arc furnace may be stabilized by superimposing a high frequency high voltage current on a low voltage alternating current supply. The indications are that neither tungsten nor graphite may be used for electrode tips with alternating current arcs because of the high losses of electrode material. (auth)

2936

SINTERED TITANIUM CARBIDE. Frank W. Glaser and W. Ivanick. J. Metals 4, 387-90(1952) Apr.

It has been shown that the pressure-sintering method permits the production of very dense, binder-free TiC

bodies, exhibiting physical properties that are generally superior to data previously reported in the literature. Two grades of TiC, containing varying amounts of graphitic carbon, were prepared and the physical properties of these two grades were related to chemical composition, powder particle size, sintering times, and temperatures. The transverse rupture strength of pressure-sintered, binder-free TiC bodies compares favorably with that of cemented carbides containing up to about 10% binder. The hot strength of titanium carbide bodies appears to be unaffected by the amount or type of binder material employed. (auth)

2937

ISOTHERMAL TRANSFORMATION CHARACTERISTICS OF AN IRON-CHROMIUM ALLOY OF TITANIUM. Charles W. Phillips and Donald N. Frey. J. Metals 4, 381-5(1952) Apr.

The titanium-rich Ti-Fe-Cr alloy, Ti-150, exhibits a martensitic reaction on rapid cooling from the single-phase body-centered-cubic β region to form a supersaturated hexagonal close-packed α. The M$_s$-M$_f$ region is approximately 1300 to 1000°F. Between 1750 and 1250°F, β decomposes isothermally to α and β of equilibrium composition by nucleation and growth; nucleation occurs throughout the β matrix above 1550°F, and only at the grain boundaries below 1550°F. At 1000°F and below, a precipitation reaction occurs causing an increase in hardness to a maximum, and eventually the growth of a dark-etching constituent as yet unidentified. (auth)

2938

THE MAGNETIC ANISOTROPY OF INDIUM SINGLE CRYSTALS. J. Verhaeghe, G. Le Compte, and G. Vandermeerssche. Mededel. Koninkl. Vlaam. Acad. Wetenschap. Belg. Klasse Wetenschap. 13, Paper No. 8(1951) Oct. 13. 9p. (In Dutch)

The distribution of magnetic susceptibility in In crystals was determined; data are tabulated and plotted.

2939

THE DETERMINATION OF TANTALUM AND NIOBIUM. N. H. Bailey. S. African Ind. Chemist 5, 235-6(1951) Dec.

A method is presented for the determination of Ta and Nb in ores, depending upon the difference in stability of solutions of Ta and Nb pentoxides in ammonium oxalate.

2940

HOW TO MACHINE TITANIUM. D. C. Goldberg and W. S. Hazelton. Iron Age 169, No. 16, 107-10(1952) Apr. 17.

Tool designs, speeds, feeds, and coolants for machining Ti are discussed. Data cover turning, broaching, drilling, tapping, reaming, and milling. Whatever the tpye of machining, machine tools must be rigid with minimum bearing play. Tools should be finished on a 150 grit or finer wheel, and should be designed so that the cutting edges have adequate clearances to avoid side drag. Titanium should never be cut with a dull tool. High pressure directional cooling on the cutting edge is important so that maximum tool life is obtained. Use of CO$_2$ gas as coolant is recommended wherever practicable.

2941

VAPOR DEPOSITION MAY SOLVE TODAY'S COATING PROBLEMS. I. E. Campbell and C. F. Powell. Iron Age 169, No. 15, 113-17(1952) Apr. 10.

Dense and uniform coatings of metals, alloys and non-metals can be deposited on one another at temperatures far below their melting points by vapor deposition. Effects of temperature of the coated surface, pressure of the reactants, and impurities in the plating atmosphere on the coating obtained are discussed. Apparatus for continuous coating of wire and for coating inductively heated nozzles is shown. A table shows deposition reaction, deposition temperature, deposition pressure, ductility of coating, and oxidation re-

sistance of coating for a number of metals, carbides, nitrides, borides, silicides, and oxides.

2942

THE PRODUCTION OF PURE CERIUM METAL BY ELECTROLYTIC AND THERMAL REDUCTION PROCESSES. P. M. J. Gray. Trans. Inst. Mining. Met. **61**, 289-98(1952) Mar. (cf. NSA 6-1688)

Attempts to produce pure Ce by electrolytic reduction of $CeCl_3$ or CeO_2 dissolved in $CeCl_3$ and by thermal reduction of $CeCl_3$ or CeF_3 with a metal are described briefly. A general discussion of conditions and difficulties involved in Ce production is included.

PHYSICS

2943

Knolls Atomic Power Lab.

THE END PROBLEM OF RECTANGULAR STRIPS, by G. Horvay. Mar. 12, 1952. 30p. (AECU-1947)

A rapidly convergent variational solution for the stresses in a rectangular strip subject on one of its narrow edges to a self-equilibrating system of stresses (i.e., stresses which have zero resultant force and zero resultant moment) is derived in the form $\varphi(x,y) = \Sigma c_n \varphi_n = \Sigma c_n f_n(y)g_n(x)$. This involves an expansion of the boundary values of the Airy function φ into a complete set of self-equilibrating orthogonal polynomials $f_n(y)$; the functions $g_n(x)$ are then determined from the Euler-Lagrange equations of the associated variational problem. This procedure has the advantage of staying entirely in the real field. The first approximation corresponds to the physical picture that the longitudinal filaments of the strip are beams on elastic foundation (the adjacent filaments furnish the elastic foundation) subject to end thrusts and lateral loads. The lowest (non-vanishing) eigenvalue γ_2 is obtained as the root of a quadratic equation in γ^2. One finds $\gamma_2 = 2.075 + 1.143i$. In higher approximations coupling effects between the orthogonal modes are also taken into account. The jth approximation to a mode φ_n is obtained by evaluating a 2j-1-rowed determinantal equation. High modes are calculated with the same facility and accuracy as is the fundamental except that the fundamental mode φ_2, not being preceded by other modes, requires, in jth approximation only a j-rowed determinantal equation. One thus finds that in third approximation γ_2 is the root of a 6th degree equation in γ^2, and has the value $\gamma_2 = 2.1061964 + 1.1253644i$. On the basis of the foregoing analysis some current practices in the use of the variational method are re-examined. Next it is shown, by quantitative formulas, that h-f (many-wiggled) components of given applied tractions penetrate less deeply into the strip than do the l-f components. Finally reference is made to several problems where use of the present method may prove to be particularly advantageous. (auth)

2944

Pennsylvania Univ.

SOME OBSERVATIONS OF RESISTANCE HYSTERESIS IN THE SUPERCONDUCTIVE TRANSITION, by W. F. Love. Issued July 3, 1951. 8p. (NYO-646)

The resistance hysteresis in the superconductive transition was measured for Sn, In, Tl, and the alloy formed of In + 5% Tl. A variety of methods of attaching current and potential leads to the specimens were tried to determine whether the connection had any effect on the resistance hysteresis measurements. The results confirmed the results of de Hass and Voogd (K. Akad. Amsterdam, Proc. Comm. No. 191d from the Phys. Lab., Leiden) and no cor-

relation was found between the resistance hysteresis and the method of attaching leads even when distorting effects of the ends of the specimen had been practically eliminated.

2945

Pennsylvania Univ.

THE DE HAAS-VAN ALPHEN EFFECT, by F. J. Donahoe, W. F. Love and F. C. Nix. Issued July 3, 1951. 15p. (NYO- 647)

The experimental equipment and procedure is described for measuring the periodic variation of one or several of the principal susceptibilities of a crystal with the magnetic field, i.e., the de Haas-van Alphen effect. Two curves are given showing this effect for Zn.

2946

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 19, 1951, by Bonnie E. Cushman. Sept. 17, 1951. 9p. (UCRL-1250)

Some Heavy-Metal Energy Cycles. Wm. Jenkins. Energy requirements for closing decay cycles suggest that the 1.9-Mev β decay of Pa^{234} does not go to the ground state of U^{234} and that the Pa^{232}-U^{232}, Np^{236}-Pu^{236}, and Am^{240}-Cm^{240} transitions have energies of 1.35, 0.51, and 0.16 Mev, respectively. There must be K capture by the Am^{240} with energy equal to 0.16 Mev and a half-life limit of >50 yr and with a β limit of >500 yr. D-P Scattering. Martin Stern. The elastic scattering of 190-Mev deuterons by carbon or polyethylene is given as a function of the angle of deflection in the center-of-mass system; total cross section is 30 ± 8 mb. The maximum counting rate occurs at an angle $\theta + \phi$ of $86°$ with an elastic peak at $70°$. Differential cross sections values for p-p scattering are 5.3 ± 0.7 and 6.2 ± 0.7 mb/steradian at $45°$ in the laboratory system. The total d-p cross section is 140 ± 30 mb, and the attenuation cross section is approximately 70 mb. Polarization in N-P Scattering. Louis Wouters. Evidence for polarization following multiple scattering of 190-Mev neutrons by a LiD target, but not by carbon, is indicated. Changes in the scattering arrangement described in report UCRL-1207 (NSA 5-4577) are discussed.

2947

Pennsylvania Univ.

THE MAGNETIC PROPERTIES OF SUPER-CONDUCTING ALLOYS OF INDIUM AND THALLIUM, by E. Callen, W. F. Love and F. C. Nix. Issued July 3, 1951. 17p. (NYO-645)

In an investigation of the properties of homogeneous solid solutions, the system In-Tl was chosen for the initial studies. The phase diagram for the system is shown. From this diagram it can be seen that Tl is soluble in In at room temperature in concentrations up to 50 at. %. Since both of these elements have transition temperatures in the region obtainable with liquid He, this system is considered a convenient one for study. Transition temperatures, critical field curves and typical magnetization curves for samples as high as 37% Tl have been determined. Some preliminary studies on a Bi-Sn alloy have also been made.

2948

THE SYSTEM NICKEL(II) NITRATE-WATER-n-HEXYL ALCOHOL AT 25°. Charles C. Templeton and Lyle K. Daly. J. Phys. Chem. 56, 215-17(1952)

The system nickel(II) nitrate-water-n-hexyl alcohol has been investigated at 25° between the limits: $Ni(NO_3)_2 \cdot 6H_2O$, water and n-hexyl alcohol. The phenomena involved in the region of two liquid phases are analogous to the corresponding portion of the aluminum nitrate-water-n-hexyl alcohol system. The hexahydrate is the solid phase in equilibrium with the saturated two liquid phase system. The differential molar rate at which water is carried into the alcoholic phase by nickel nitrate is about 4.

2949

ABSOLUTE VISCOSITY OF WATER AT 20°C. J. F. Swindells, J. R. Coe, Jr., and T. B. Godfrey. J. Research Natl. Bur. Standards 48, 1-31(1952) Jan.

By means of a calibrated injector, various known constant rates of flow were produced in capillaries of measured dimensions, and observations were made of the corresponding pressure drops through the capillaries. The effects of the ends of the capillaries were rendered negligible by the simultaneous treatment of data obtained with pairs of capillaries having essentially the same diameters but different lengths. The value found for the viscosity of water is 0.010019 poise as compared with 0.01005 poise, which has generally been accepted for the past 30 years. The estimated accuracy of the new determination is ± 0.000003 poise. As a result of this work, beginning on July 1, 1952, the National Bureau of Standards is planning to use the value 0.01002 poise for the absolute viscosity of water at 20°C as the basis for the calibration of viscometers and standard-sample oils. It is recommended that other laboratories adopt this value as the primary reference standard for comparative measurements of viscosity.

2950

ISOTOPE EFFECT IN THE IMPRISONMENT OF RESONANCE RADIATION. T. Holstein, D. Alpert, and A. O. McCoubrey. Phys. Rev. 85, 985-92(1952) Mar. 15.

On theoretical grounds it is expected that the decay time of imprisoned resonance radiation in the vapor of a single even isotope of mercury should be some six times larger than that observed with the natural samples of mixed isotopic constitution. To investigate this effect experimentally, decay measurements were carried out with samples of Hg^{198} (3% Hg^{199} and 0.1% Hg^{200}). For vapor densities $N \approx 10^{14}$/cc, the predicted effect was verified. For $N > 10^{14}$/cc, the observed decay time drops below that predicted theoretically for pure Hg^{198}. This secondary effect is here attributed to the transfer of excitation from Hg^{198} to Hg^{199} and Hg^{200} by collisions of the second kind. Comparison of experimental data with an appropriately generalized theory permits estimation of the cross section for such collisions. The value so obtained is 10^{-13} cm^2, some 20 times the gas-kinetic cross section, and in order-of-magnitude agreement with theoretical expectations. (auth)

2951

ZEEMAN EFFECT AND HYPERFINE SPLITTING OF POSITRONIUM. Martin Deutsch and Sanborn C. Brown. Phys. Rev. 85, 1047-8(1952) Mar. 15.

The hyperfine splitting, $\Delta W/h$, in the positronium line $(1, \pm 1) \rightarrow (1,0)$ has been measured in a 9000-gauss magnetic field at a frequency of 3000 Mc. The transition was detected by the increase, at resonance, of two-photon annihilation relative to the three-photon process in argon and Freon. Cu^{64} was used as the positron source. An unexpected complication arose from the fact that the high r-f fields (about 1000 v/cm) used increased the amount of positronium formed, probably by accelerating some slow positrons to the energy required for electron capture.

2952

EXPERIMENTS WITH AUDIOFREQUENCIES ON SUPERCONDUCTORS. B. Serin and C. A. Reynolds. Phys. Rev. 85, 938-9(1952) Mar. 1.

Certain aspects of the experiments reported by Serin et al. (Phys. Rev. 84, 802-5(1951); NSA 6-920) are described in greater detail in answer to criticisms by Galkin and Bezuglyi (Zhur. Eksptl'. i Teoret. Fiz. U.S.S.R. 20, 1145 (1950)).

ASTROPHYSICS

2953

THE ORIGIN OF ATMOSPHERIC OXYGEN AND ITS ISOTOPIC COMPOSITION. Malcolm Dole. Bol. soc. quím. Peru 17, 135-58(1951) Sept. (In Spanish)

Following a brief discussion of the origin of the atmospheres of the earth and planets, the author discusses the variations in isotopic ratios found in the oxygen of the air, ocean, plants, etc. with respect to possible mechanisms of isotope separation resulting in these variations.

COSMIC RADIATION

2954

Syracuse Univ.

PROGRESS LETTER, by Kurt Sitte. July 28, 1951. 2p. (NYO-974)

Brief report is made of the status of the Syracuse and Echo Lake experiment on local showers and the apparatus being used. No experimental data are given.

2955

ON THE PROBLEM OF MESON GENERATION AND THE LATITUDE EFFECT. II. M. Ferretti Sforzini. Nuovo cimento (9) 8, 909-13(1951) Dec. 1. (In Italian; cf. NSA 4-4929)

Using the results obtained in a previous paper for the determination of the number $\Lambda (W, E, \lambda)$ of mesons which arrive at sea level from all possible directions, and which have been generated with an energy E by a nucleon of energy W at a latitude λ, the total intensity of meson radiation at sea level has been calculated as a function of the latitude, using the Heisenberg hypothesis of production. The results of calculation are compared with the experimental data. (auth)

2956

ON THE NUCLEONIC COMPONENT IN THE ATMOSPHERE. E. Clementel and G. Puppi. Nuovo cimento (9) 8, 936-51 (1951) Dec. 1. (In Italian)

The authors reconsider the problem of the scattering of the low-energy nucleonic component in the atmosphere, which is described by two distinct equations for protons and neutrons. The absorption mean free path in the low and middle atmosphere is consistent with experiment. The authors discuss further experimental data on vertical intensity of protons and different parameters involved in the description of the scattering of the components. (auth)

2957

OBSERVATION OF ROSSI SHOWERS WITH A WILSON CHAMBER. Jean Daudin and Tsai-Chü Compt. rend. 234, 1277-8(1952) Mar. 17. (In French)

Three small (6-cm^2 area) counters were arranged inside a Wilson cloud chamber, which was tripped only by coincidences in all three counters. Pb screens 15-mm to 12-cm thick could be placed inside the chamber above the counters. Numerous observations with this apparatus located on the Pic du Midi (2860 m) show clearly that the usual studies of Rossi showers do not take correct cognizance of the number of air showers, the high frequency of shower-producing primaries, or the number of rays per shower.

2958

POSITIVE EXCESS OF MESONS AT 2000 METERS. P. Bassi, I. Filosofo, C. Manduchi, and L. Prinzi. Nuovo cimento (9) 8, 469-74(1951) July 1. (In Italian)

The positive excess, $2(N^+ - N^-)/(N^+ + N^-)$, in cosmic radiation at 2000-m altitude has been measured by deflecting both positive and negative mesons through a magnetic field of 12,300 gauss. For momenta between 4.5×10^8 and 5.5×10^8 ev/c, the positive excess was 0.18 ± 0.05, and for momenta between 13.5×10^8 and 14.5×10^8 ev/c, 0.38 ± 0.06.

2959

ABSENCE OF SECONDARY MAXIMA IN THE TRANSITION CURVE FOR ELECTRONIC SHOWERS. R. Maze. Phys. Rev. 85, 697-8(1952) Feb. 15.

A small maximum at 7 cm of Pb was previously reported (Maze and Tsai-Chü, Compt. rend. 232, 224(1951)) in the Rossi curve for electronic showers. The experiment has

been repeated, and it is concluded that this maximum was due to statistical or other fluctuations and should not be considered.

2960

A PROBABLE EXAMPLE OF MULTIPLE PRODUCTION OF MESONS. M. Demeur, C. Dilworth, and M. Schonberg. Nuovo cimento (9) 9, 92-4(1952) Jan. 1. (In English)

An interesting star found in an Ilford G5 plate exposed in a 22,000-gauss magnetic field on the Pic du Midi (2800 m) is discussed. The star has six minimum ionization branches of small angular divergence, no visible primary, and a single low-energy proton track. There is a small angle pair 500μ from the center of the star, nearly parallel to, and 2μ from one of the branches. The total kinetic energy of the secondaries is 9 bev. As an example of multiple meson production, assuming the primary was a neutron, the event is difficult to explain on the basis of any of the current models of this process.

2961

TRANSITION EFFECTS ON DISINTEGRATION STARS IN NUCLEAR PLATES UNDER SMALL THICKNESSES. G. Belliboni, L. Fabbrichesi, L. de Marco, and M. Merlin. Nuovo cimento (9) 8, 374-82(1951) June 1. (In Italian)

New results are reported on disintegration stars observed in nuclear plates exposed at 4550 m under thin layers of Pb and Al. The maximum found in a previous experiment at 0.5 cm of Pb and 2 cm of Al for 3- or 4-prong stars is confirmed. The slope of absorption curves for stars with 5 or more prongs in the first 2 or 3 cm of absorber is clearly higher than that related to the geometrical cross section. The possible explanations of these effects are discussed taking into account both the ionization loss of primary protons and the production of stars by photodisintegration. (auth)

2962

THE DIFFERENTIAL RANGE SPECTRUM OF COSMIC-RAY MESONS AT SEA LEVEL. Carl M. York, Jr. Phys. Rev. 85, 998-1103(1952) Mar. 15.

The low-energy region of the differential range spectrum of cosmic-ray mesons at sea level has been investigated by means of a counter-controlled cloud chamber. The results obtained in the region from 18 to 76 g/cm^2 of air-equivalent absorber have proved to be about 20% higher than predictions based on similar measurements at greater absorber thicknesses. A possible explanation of this discrepancy lies in the consideration of the effect of multiple scattering of mesons in previous experiments. The present experiment employs a geometrical arrangement of the apparatus which minimizes the corrections to be applied to the data to allow for loss of mesons from the apparatus due to scattering. The earlier work in the field has not been corrected for scattering effects and can, as a result, be expected to give too low a value of the spectrum. The average differential intensity of mesons measured in the range interval mentioned is 6.86×10^{-6} particles/sec/sterad/g. The differential range spectrum of protons was also measured and is in good agreement with other work which measured the spectral values at somewhat higher energies. The proton intensity is 2.12×10^{-6} particles/sec/sterad/g in the region 16.5 to 42.3 g/cm^2 of air equivalent and 0.67×10^{-6} particles/sec/sterad/g in the region 42.5 to 63.3 g/cm^2 of air equivalent. (auth)

2963

NUCLEONIC COMPONENTS AT HIGH ALTITUDES. K. Sakihama and S. Takagi. Progress Theoret. Phys. (Japan) 6, 1017-20(1951) Nov.-Dec.

Calculations are given of the nucleonic components at high altitudes in an attempt to determine the contribution of primary α particles on the high-energy neutron-proton ratio. Results of the calculations are such that a decisive

conclusion on the ratio cannot be made because of the low accuracy of experimental data.

2964

ABSORPTION EXPERIMENT TO DETECT THE COSMIC-RAY ALBEDO AT HIGH ALTITUDES. J. R. Winckler. Phys. Rev. 85, 1052-4(1952) Mar. 15.

An attempt was made to measure cosmic-ray particle direction at 80,000 ft over Minneapolis by a Geiger telescope inclined at a fixed zenith angle of 60°. A large Pb block 6.5 in. thick, weighing 105 lb, and completely covering the telescope solid angle was placed below the telescope. The telescope was periodically removed from the Pb block. Negative results obtained are ascribed to obscuration of the true albedo effect by the higher shower rate observed when telescope and block were aligned.

2965

APPLICATION OF ČERENKOV RADIATION TO THE COSMIC-RAY ALBEDO PROBLEM. J. R. Winckler. Phys. Rev. 85, 1054-5(1952) Mar. 15.

An apparatus to measure cosmic-ray particle direction by Cherenkov radiation is described. The solid angle between the tubes of a Geiger telescope is filled with lucite, to a slant face of which is optically sealed an end-window photomultiplier. The efficiency ratios of Cherenkov counts to total telescope counts at various atmospheric depths are tabulated. Calculated albedo data of poor statistical accuracy are given.

2966

INCREASE OF COSMIC RAY INTENSITY IN CORRELATION WITH METEORIC ACTIVITY ON NOV. 6-7, 1951. J. Clay, H. F. Jongen, and A. J. Dijker. Proc. Koninkl. Nederland. Akad. Wetenschap. 54B, 430-1(1951) Nov.-Dec. (In English)

During measurements of cosmic-ray intensity a simultaneous increase was noted on Nov. 6-7, 1951 in three ionization counters under various thicknesses of Fe shielding. This increase could not be associated with solar flares. The increase coincided with a period of activity of the Taurid meteors from Nov. 1 to 10. A variation in the Störmer current by the meteors, altering the Störmer pass for higher energy particles is suggested as an explanation of the increase.

2967

PRODUCTION CROSS SECTION AND ENERGY SPECTRUM OF THE NEUTRAL MESONS IN COSMIC RAYS. G. Salvini and Y. Kim. Phys. Rev. 85, 921-2(1952) Mar. 1.

Data are summarized as taken at Echo Lake, Colo., on energy distribution and production cross sections of neutral mesons and the ratio of neutral to charged mesons with respect to the number of shower particles.

ELECTRICAL DISCHARGE

2968

Research Lab. of Electronics, Mass. Inst. of Tech. HIGH-FREQUENCY GAS DISCHARGE BREAKDOWN, by Sanborn C. Brown. Apr. 12, 1951. 15p. (NP-3130; Technical Report No. 195; U17867)

A phenomenological description of HF gas discharge breakdown is given. The effects of superimposing on the a-c field a small d-c field and a magnetic field are also discussed. (auth)

ELECTRONS

2969

Radiation Lab., Univ. of Calif. EXPERIMENTAL EVIDENCE FOR CLASSICAL ELECTRON RADIATION, by Joseph W. Mather. Mar. 28, 1952. 6p. (UCRL-1742)

An experiment, using the 320-Mev Berkeley synchrotron, is reported which verifies the theoretical prediction of

classical electron radiation. The method used involves measuring a particular time on the decreasing portion of the magnetic cycle, after the r-f accelerating voltage of the synchrotron has been turned off, when the rate of shrinkage of the electron orbit (due to electron radiation) is just compensated for by an expansion of the electron orbit caused by the negative rate of change of the magnetic field. The time when the x-ray signal vanished was measured to the 2900 ± 50 μsec.

GASES
2970
MODERN METHODS OF GAS ANALYSIS. Henri Guérin. Bull. soc. chim. France, 24-33(1952) Jan.-Feb. (In French)

Analysis of gas mixtures by methods requiring separation, such as fractional distillation or absorption with conductivity or calorimetric measurements, and by methods not requiring separation, such as thermal conductivity, magnetic susceptibility, absorption spectra, or mass spectrometry, is reviewed.

INSTRUMENTS
2971
Atomic Energy Project (Canada)
OPERATING AND TECHNICAL MANUAL; GENERAL PURPOSE COUNTING-RATE METER AEP 1902, by R. J. Cox. Mar. 10, 1950. 30p. (IM-6; NRC-2398)

The operating and technical manual for a general-purpose counting-rate meter is given. The instrument is designed to accept a wide range of input pulse shapes. The pulses are converted by an amplifier, attenuator, and univibrator to provide equal pulse amplitudes of selectable duration. These pulses are used to feed a "metering" condenser. This, through a "diode pump" circuit, feeds equal increments of charge per pulse to a tank circuit through a d-c current amplifier with negative feedback. The circuit used allows measurement of tank circuit output at low impedance and minimizes effects of line voltage variations and changes in tube characteristics. Eight different "metering" condensers provide eight ranges and three different tank condensers provide three integrating time constants. An output for an 0 to 1 ma external meter or recorder is provided.

2972
Naval Research Lab.
UPPER ATMOSPHERE RESEARCH REPORT NO. X; THE MATRIX TELEMETERING SYSTEM, by J. T. Mengel, N. R. Best, D. G. Mazur, and K. M. Uglow. Sept. 19, 1949. 91p. (NRL-3535)

2973
Research Lab. of Electronics, Mass. Inst. of Tech.
INTERACTION OF MODES IN MAGNETRON OSCILLATORS, by R. R. Moats. June 25, 1951. 55p. (NP-3679; Technical Report No. 171; U21245)

The magnetron is discussed in terms of its properties as a feed-back oscillator in order to show that nonlinear circuit theory may be applied in analyzing mode interactions. The problems under study concern mode selection or the establishing of oscillation in the desired mode and mode stability in either pulse of c-w magnetrons. The interaction of modes in a nonlinear feed-back oscillator with 2 resonances was examined. The development established that large-amplitude oscillation in one mode tends to suppress oscillation in other modes. This supports the mode-competition theory advanced by Rieke (Microwave Magnetrons, M.I.T. Rad. Lab. Series 6, McGraw-Hill, 1948). These theoretical observations were supported directly by measurement of the loading effect of an oscillating mode in a magnetron upon small-amplitude externally supplied oscillations in another mode; they were also supported

indirectly by observation of the performance of several different types of magnetrons. (NRS abst.)

2974
Argonne National Lab.
INSTRUMENT RESEARCH AND DEVELOPMENT DIVISION QUARTERLY REPORT; DECEMBER, 1951, JANUARY AND FEBRUARY, 1952. [nd] 13p. (ANL-4778)

The average energy to make an ion pair in gases by α particles from Po was determined to be 24.4 ± 0.15 ev/pair in A and 24.1 ± 0.15 ev/pair in Kr. Progress is reported in procurement and organization of equipment to be used for the detection of low-energy radiations by means of proportional-counter spectrometers. Construction of a noise and hum tester is reported. A circuit diagram for a modified method for measuring high resistivities in insulators is included. Progress is reported in the investigation of plastic phosphors. A calculation was made of the piping efficiency of a circular rod as a function of the position of the source. Results indicate the undesirability of using internally reflecting light guides in scintillation spectrometry, where uniform transmission of light is necessary.

2975
Atomic Energy Project (Canada)
HIGH SPEED SCALE X 8 TYPE AEP 908-1, by W. D. Howell. Apr. 1950. 14p. (IM-9; NRC-2401)

The high speed scale X 8 (AEP-908-1) described was designed for incorporation in the N.R.C. standard scaling equipment. The scaler will count at a rate of 2.5×10^6 cpm for a 1% counting loss. The unit consists of 3 binary circuits arranged in cascade. Although a resolving time of 0.25 μsec does not represent the ultimate in a binary counter circuit, it nevertheless provides a criterion for reliability of performance and does in fact exceed the resolving time of any standard amplifier equipment presently available.

2976
Los Alamos Scientific Lab.
STANDARD ELECTRONICS EQUIPMENT [HANDBOOK]. [nd] Decl. Mar. 26, 1952. 42p. (AECD-3348; LADC-1110)

A handbook on the standard electronics equipment developed by the Electronics Group at Los Alamos is presented. The handbook is divided into sections entitled: General, Power Supplies, Pressure and Vacuum Controls, Health Instruments, Amplifiers, Scalers, Pulsers, and Miscellaneous.

2977
Atomic Energy Project (Canada)
PROGRESS REPORT NOVEMBER 16, 1951—FEBRUARY 15, 1952; ELECTRONICS BRANCH, by J. Hardwick. [nd] 15p. (PR-P-13-E)

Brief statements are made of the progress of the Electronics Branch, Atomic Energy Project (Canada), from Nov. 16, 1951, to Feb. 15, 1952. Titles of projects reported are: Single Crystal Spectrometer, Radiation Probe for Clinical Use, Measurement of Rn in Breath, Radiation Detector for Aerial Survey and Ra Content of the Body, Radiation Measuring Instruments for Civil and Military Defense, Thermionic Tubes, Cold Cathode Tubes, Transistors, Reactor Analogue Computor, Harmonic Generator and Mixer for Pair Spectrometer, Automatic Recording Electroscope, Low Background Anti-Coincidence Unit for Auto-Turntable, Blood Pressure Measurement in Rats Using Strain-Gauge, Leak Detector, Automatic Scaling Equipment, Logarithmic Ratemeter, Hand and Foot Monitor, and A Millisecond Pulsing Unit for a X Ray Machine. No conclusive data are given.

2978
Radiation Lab., Univ. of Calif.
PERFORMANCE OF CERENKOV DETECTOR, by J. W. Mather and E. A. Martinelli. Mar. 6, 1952. 7p. (UCRL-1646)

The performance of a Cherenkov detector similar to Marshall's (Phys Rev. 81, 275(1951)) utilizing lucite as the

Cherenkov radiator is reported. The effective aperture was found to be approximately ¾ in. at half maximum while the angular acceptance at half maximum was 2.5⁰. The over-all efficiency, namely the ratio of observed coincidence counting rate to the number of γ rays incident on the lucite radiator was as high as 21%. Measurements of a γ ray transition curve for Cu and Pb showed that the curve for Cu and Pb reached the same value but were displaced with respect to each other.

2979

Research Lab. of Electronics, Mass. Inst. of Tech.
EXPERIMENTAL STUDY OF OPTIMUM FILTERS, by Charles A. Stutt. May 15, 1951. 127p. (NP-3107; Technical Report No. 182; U17505)

A study was made of the use of mean-square-error (m.s.e.) criterion in network and communication-theory problems. It concerned the development of a time-do-main technique for use in Wiener's theory for the linear system, and the compilation of experimental data on the performance of optimum-mean-square (o.m.s.) filters on certain idealized problems. One part of the design technique is a specification of the impulse response of o.m.s. filters, and is pointed toward interpreting this response directly in terms of experimental correlation data. The method hinges on a time-domain solution of the Wiener-Hopf integral equation. A second part is devoted to a laboratory scheme of synthesis for this response. A flexible network, based on the convolution integral, is described. The device incorporates a delay line having multiple taps with provision for linearly combining the voltage of each tap into a common output. The transient voltage evoked in this circuit can be shaped by independent adjustment of the taps. The delay-line network is shown to be useful in the evaluation of Fourier transforms and convolution integrals and as an information storage device. Problems, especially adapted to the m.s.e. theory, and equipment for their study in the laboratory are described, and experimental results on the performance of o.m.s. filters and a Butterworth-type filter are presented. These results include measured values of the m.s.e., noise-to-signal ratio, and pictures of pertinent wave forms. These experiments indicate that the m.s.e. network specifications may be used advantageously as standards in conventional designs, that o.m.s. designs are relatively noncritical, and that the theory needs strengthening by the inclusion of some interpretation of what is objectionable in an error function. (auth)

2980

A METHOD OF PULSE INTEGRATION USING THE BINARY SCALING UNIT. F. M. Glass and G. S. Hurst. Rev. Sci. Instruments 23, 67-72(1952) Feb.

In some cases it is desirable to determine the dose resulting from certain types of ionizing radiation by weighting the pulses produced in a proportional counter by their height. An instrument that automatically integrates pulses in such a fashion is described. The pulses actuate one or more of a series of discriminators which are biased at successively higher voltages. The discriminators are connected into successive stages of two binary scaling units in such a way that the total number of counts recorded is proportional to the height of the initial pulse. (auth)

2981

A WIDE-BAND ELECTROMETER AMPLIFIER. I. Pelchowitch and J. J. Zaalberg Van Zilst. Rev. Sci. Instruments, 73-75(1952) Feb.

It is shown that by appropriate feed-back methods it is possible to construct a wide-band electrometer amplifier with a stable flat-response characteristic. By analysis the signal-to-noise ratio has been found to be most favorable in the case where the mean frequency of the amplifier is low. Some practical values of the circuit are given. (auth)

2982

ELECTRON INTERFEROMETER. L. Marton. Phys. Rev. 85, 1057-8(1952) Mar. 15.

The basic principles of an interferometer operating with electron beams are discussed. The usefulness of such an instrument, one of which is under construction, is manifold. It constitutes an extremely sensitive device for measuring gradients of magnetic or electrostatic fields. By producing large differences of optical paths it may be used for the determination of the limit of coherence of an electron beam. It could be used for the determination of the band structure of electron emitters. Another possible use may be the study of internal potentials in solids.

2983

THE VELOCITY OF 170-MEV GAMMA-RAYS. David Luckey and John W. Weil. Phys. Rev. 85, 1060(1952) Mar. 15.

As a test of a high-resolution coincidence circuit for experiments utilizing monoenergetic γ rays selected from bremsstrahlung, the velocity of 170-Mev γ rays has been measured. The bremsstrahlung was produced by 310-Mev electrons bombarding a thin target. The velocity of the coincident γ rays was determined by measurement of relative delay time vs. position of a movable, external, scintillation counter. A value of 2.974×10^{10} cm/sec, with estimated probable error of 1% was determined.

2984

AN ELECTRICAL FLOWMETER FOR RECORDING BLOOD FLOW. I. G. Baxter. Electronic Eng. 24, 162-5(1952) Apr.

A flowmeter was designed for continuously recording the rate of flow of blood to the lungs of an animal, in connection with research on respiration. The instrument embodies a differential-capacitance manometer that registers the pressure output from a minature pitot head, which is built into a special cannula that can be inserted into the pulmonary artery. A schematic diagram and circuit diagrams for the instrument are included. Details of the cannula and the more physical aspects of the system are described in J. Physiol. 115, 410(1951).

ISOTOPES

2985

Tracerlab Inc.
INDUSTRIAL APPLICATIONS OF RADIOISOTOPES; A SELECTED BIBLIOGRAPHY, by Jerome Kohl, comp. Jan. 3, 1952. 9p. (NP-3761)

A bibliography is presented covering general articles on the applications of radioisotopes, food technology uses, agricultural, chemical and detergent applications, friction and wear studies, uses in location of pipe line leakage, measurement of density, water content and concentration, metallurgy, mineralogy, corrosion, protective coatings, radiography, static elimination, and general industrial application.

2986

Technical Information Service, AEC
RADIOISOTOPE APPLICATIONS OF INDUSTRIAL SIGNIFICANCE; AS LISTED IN "ISOTOPES—A FIVE-YEAR SUMMARY OF U. S. DISTRIBUTION." [nd] 64p. (TID-5078)

This list, extracted from "Isotopes—A Five-Year Summary of U. S. Distribution," includes radioactive isotope allocations made from Aug. 2, 1946 through June 30, 1951, and considered to be of significance to industry. Institution, investigator, isotope, project, and status or journal reference are given for each. A subject index is included.

2987

LIMITS OF ISOTOPIC ABUNDANCE FOR HAFNIUM AND PLATINUM. H. E. Duckworth, R. F. Woodcock, G. S. Stanford, A. Coutu, and R. L. Stearns. Phys. Rev. 85, 929-30(1952) Mar. 1.

The following limits have been determined with a Dempster-type double focusing mass spectrometer. The abundance of Hf^{174} was assumed to be 0.18% and that of Pt^{190}, 0.012%.

Nuclide	Limit of abundance (%)
Hf^{170}, Hf^{171}	0.004
Hf^{172}, Hf^{173}	0.005
Hf^{175}	0.006
Pt^{188}, Pt^{189}	0.002
Pt^{191}	0.004
Pt^{193}	0.009
Pt^{197}	0.010
Pt^{199}	0.008
Pt^{200}	0.007

ISOTOPE SEPARATION
2988

SOME CHARACTERISTICS OF STEDMAN PACKING IN THE DISTILLATION OF HYDROGEN AND ITS ISOTOPES. Abraham Fookson, Philip Pomerantz, and Simon Rothberg. J. Research Natl. Bur. Standards 47, 449-55(1951) Dec.

Apparatus was designed and constructed in which some characteristics of Stedman packing in the distillation of hydrogen isotopes were measured. The average still hold-up and the hold-up at various boil-up rates were measured using both hydrogen and deuterium as still charge. Mixtures of hydrogen-hydrogen deuteride of known composition were distilled at boil-up rates of 454 milliliters per hour and 1190 milliliters per hour, respectively. From the distillation data the height equivalent to a theoretical plate was calculated and found to be 1.0 inch for the 12-inch packing used in these experiments. (auth)

MASS SPECTROGRAPHY
2989

Scott Lab. [of Physics], Wesleyan Univ., Middletown
MASSES OF Pd^{104}, Pd^{108}, Pt^{195} AND CU^{65}, by Henry E. Duckworth, Karl S. Woodcock and Richard S. Preston. [nd] 4p. (NYO-622)

This material appeared in Phys. Rev. 78, 479-80(1950) and was abstracted in Nuclear Science Abstracts as NSA 4-3999.

2990

Connecticut Univ.
GEIGER-MÜLLER COUNTER RESEARCH WITH MASS SPECTROSCOPY, by Stephen S. Friedland and Henry S. Katzenstein. July 1, 1951. 36p. (NYO-824)

An analytical mass spectrometer was designed for ease of operation and maintenance, speed of scanning, and flexibility of use. G-M counters were prepared with various combinations of cathodes and gases and their contents were analyzed with the mass spectrometer after a predetermined number of counts. Selective effects were looked for and some preliminary results have been obtained. It has been established that ethyl acetate does dissociate with use and that the end product is CO_2. A series of experiments have been performed to study the effects of pitting of the center wire of the counter. A new method has been developed to determine the ionization potential of gases from their ion-efficiency curve. In addition the same measurements may be utilized to give the shape of the ionization cross section curve. (auth)

2991

Wesleyan Univ., Middletown
SOME NEW MASS COMPARISONS INVOLVING Si, Fe, Ni, Cu, Zn, W, AND Pt, by Henry E. Duckworth, Howard A. Johnson, Richard S. Preston, and Richard F. Woodcock. Mar. 16, 1950. 17p. (NYO-620)

This material appeared in Phys. Rev. 78, 386-90(1950) and was abstracted in Nuclear Science Abstracts as NSA 4-4003.

MATHEMATICS
2992

Los Alamos Scientific Lab.
THE EVALUATION OF DEFINITE INTEGRALS, AND A QUASI-MONTE-CARLO METHOD BASED ON THE PROPERTIES OF ALGEBRAIC NUMBERS, by R. D. Richtmyer. Oct. 13, 1951. 30p. (LA-1342)

A formula is given for the approximate evaluation of multiple definite integrals using the ergodic property of a certain transformation of the unit cube into itself. Estimates of the rate of convergence are made for sufficiently smooth integrand. The work was motivated by a belief, that appeared at one time justified, that a substantial improvement of the accuracy of Monte Carlo method would result from use of the principles described herein. Although that belief proved groundless in numerical tests, it is deemed worthwhile to give this report of the work. (auth)

2993

Massachusetts Inst. of Tech.
MACHINE METHODS OF COMPUTATION AND NUMERICAL ANALYSIS. Dec. 15, 1951. 14p. (NP-3694; Quarterly Progress Report No. 2; U20928)

Brief reports are given of progress on the following research: variational calculation of nuclear scattering; computation of an integral occurring in second Born approximation calculations; lift and hinge moment calculations in the solution of aerodynamic equations; machine methods for processing x-ray diffraction data; and integration of hyperbolic partial differential equations. (cf. TIP U20413) (NRS abst.)

2994

Los Alamos Scientific Lab.
MONOTONIC SET FUNCTIONS AND CONVEX SETS, by P. C. Hammer and Andrew Sobczyk. [nd] 19p. (AECU-1948; LADC-1142)

Monotonic set functions can be considered as one class of the possible generalizations of measure. In this work the authors associate functionals with monotonic set functions in a certain fashion. With suitable restrictions the associated functional g(x) will be quasi-convex, i.e., if $x_a = ax_1 + (1-a)x_0$, $0 < a < 1$, then $g(x_a) \leq \max[g(x_1), g(x_0)]$. Application of results to n-dimensional Euclidean space is preceded by a discussion of the notion of semispaces and it is shown that every convex set in E_n which is not the entire space is an intersection set of a class of semispaces. The results constitute generalizations of earlier work by Dupin and others, concerned with the separation of mass distributions by hyperplanes in E_n. These generalizations extend the earlier work in many directions by weakening nearly all assumptions of continuity, connectedness and boundedness of domains, and in going to monotonic set functions. Successive strengthenings of hypotheses show the role which the various assumptions play in establishing conclusions. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES
2995

Brookhaven National Lab.
LIQUID SCINTILLATION COUNTERS, by C. E. Falk and H. L. Poss. [nd] 37p. (BNL-1145)

A review of the present status of liquid scintillators is given. The theory explaining the properties of the counters is discussed. Preparation of counters is described and counter characteristics such as emission spectra, response to various nuclear radiations, counting efficiencies, and emission intensities from various scintillating solutions are

given. The applications of liquid scintillation counters in various fields of nuclear physics are discussed. (auth)

2996

Brookhaven National Lab.

CHEMICAL DOSIMETRY USING FERROUS SULFATE AND CERIC SULFATE SOLUTIONS, by Jerome Weiss. Mar. 26, 1952. 17p. (BNL-1139)

Procedures to be followed when using ferrous sulfate or ceric sulfate solution as a dosimeter are outlined. Results from both systems were found to be reproducible and independent of dose rate and intensity over a wide range. The Fe system is dependent upon O_2 concentration, and appropriate precautions must be taken. The ceric sulfate dosimeter seems to be better for high total doses and the ferrous dosimeter better for doses less than 50,000 rep. The dose rate increases slightly as the internal diameter of the sample container decreases below 10 mm.

2997

Radiation Lab., Univ. of Calif.

SURVEY METHODS FOR NEUTRON FIELDS, by Burton J. Moyer. Jan. 11, 1952. 39p. (UCRL-1635)

Several methods are described for estimating neutron flux densities in each of three energy categories: slow (thermal and near-thermal), fast (0.3 to 15 Mev), and high-energy (>20 Mev). The methods described for slow-neutron determinations are: use of BF_3 counters, BF_3 ionization-current method, and foil-activation methods. Fast-neutron fields may be evaluated by the following methods: monitoring with nuclear track film, the substitution method with an energy-insensitive counter, the balanced-chamber method, application of the Bragg-Gray principle (Proc. Cambridge Phil. Soc. 40, 72(1944)), use of a directional count-rate meter for "tissue dose," or by measurement of the fast-neutron-energy flux density. High-energy neutron flux densities can be measured by means of the Bi fission counter or by observation of nuclear stars and recoils in photographic emulsions.

2998

Rochester Univ.

A FAST COINCIDENCE USING A GATED-BEAM TUBE, by Kurt Enslein. Apr. 3, 1952. 3p. (NYO-3210)

The circuit for a fast coincidence using a gated-beam tube is given. The resolving time of the circuit is of the order of 5×10^{-9} sec. The operation and performance of the circuit is briefly described.

2999

Rochester Univ.

A COAXIAL CABLE DRIVER WITH GAIN, by Kurt Enslein. 7p. (NYO-3202)

A circuit utilizing a triode amplifier in order to drive a coaxial cable is given. The theory of the circuit is developed to show why the use of a triode amplifier is superior to use of the same tube as a cathode-follower. The performance of this circuit and the possible trouble spots in similar circuits are discussed.

3000

Radiation Lab., Univ. of Calif.

HIGH ENERGY PARTICLES AND THE SCINTILLATION COUNTER, by L. F. Wouters. Feb. 26, 1952. 29p. (UCRL-1693)

A report is presented on the application of the scintillation counter to the detection of high-energy particles. Particle-scattering and meson experiments are discussed with reference to the types of counting equipment employed.

3001

Naval Research Lab.

HIGH IMPEDANCE CHAMBERS, by D. S. Toffolo. Mar. 26, 1952. 4p. (NRL-3953)

The maximum impedance of an ionization chamber which is filled with an argon-carbon dioxide mixture and which generates a voltage signal for propagation by a coaxial transmission line is shown to be a function of the applied d-c potential. (NRL abst.)

3002

Naval Research Lab.

AGING CHARACTERISTICS OF GEIGER TUBES, by S. W. Lichtman and R. W. Kreplin. Mar. 18, 1952. 11p. (NRL-3948)

Results of a study of storage aging characteristics involving several hundred Geiger tubes of type BS-1 geometry, conducted over a period of two years, indicate that progressive changes occur in the plateau length and in the threshold voltage with storage duration. The change rate is related to the gas filling and to the conditioning treatment. A stability coefficient, S, is determined which identifies the useful shelf life of a tube in terms of the permissible change in threshold voltage. Several filling procedures are disclosed each capable of a maximum threshold voltage change of 25 volts or less over a 5-year period of storage. (NRL abst.)

3003

Atomic Energy Project, Univ. of Calif., Los Angeles

THE CHLOROFORM-ALCOHOL-DYE SYSTEM, by George V. Taplin, Clayton H. Douglas, and Sanford C. Sigoloff. Issued Apr. 2, 1952. 20p. (UCLA-192)

The chloroform-alcohol-dye method of measurement of high energy gamma radiation provides a simple way to estimate (± 10-20%) most of the critical dosage ranges (50 to 600 r) having medical importance in atomic warfare. The system may be rendered sufficiently heat stable, temperature and rate independent, by adding ethyl alcohol in concentrations of 1 to 2%. Furthermore, the problems of spectral dependence and light sensitivity may be solved by packaging the dosimeter tubes in light proof metal cases. The fundamental mechanism of the radiation induced chemical changes involves a chain reaction, which can be controlled by adjusting the alcohol content in the system. Representative data regarding the radiation characteristics and stability of the reagents are presented. The applicability of the method to the manufacture of self-reading roentgen or gamma radiation dosimeters useful in the event of atomic warfare, or for special purposes in clinical radiation therapy and health physics has been demonstrated. (auth)

3004

Rochester Univ.

CONSTRUCTION AND CALIBRATION OF A FAST NEUTRON SCINTILLATION SPECTROMETER, by G. L. Guernsey, G. R. Mott, B. K. Nelson, and A. Roberts. Apr. 4, 1952. 20p. (NYO-3048)

A quadruple coincidence scintillation counter telescope has been constructed for neutron studies with the University of Rochester 130-in. synchrocyclotron. A calibration of pulse height vs. proton energy has been obtained for the fourth crystal of the telescope. The response of this crystal to monoenergetic protons has been found to be in fair agreement with calculations for the distribution of energy loss for protons, made using the method developed by K. R. Symon (Thesis, Harvard Univ. 1944). The instrument covers the range from about 50 to 240 Mev in recoil proton energy. (auth)

3005

USE OF LIQUID EMULSIONS IN THE STUDY OF RADIOACTIVITY OF ROCKS. E. E. Picciotto. Bull. centre phys. nucl. univ. libre Bruxelles, Note No. 33(1952) Jan. 13p. (In French)

The technique of using gel-form nuclear emulsions in the study of Th/U ratios, radioactive equilibria, and localization

of radioactive constituents in rocks and minerals is described. Some representative radioautographs of radioactivity distribution in microdiorite and granodiorite taken with 35- and 100-μ Ilford gel-form emulsions are shown.

3006

QUANTITATIVE DETECTION OF SCATTERED X RADIATION BY A PHOTOMETRIC METHOD. Jan Lorens. Polski Tygodnik Lekarski 6, 883-7(1951). (In Polish)

Use of dental film to measure the quantity of radiation scattering during x-ray therapy is described. Simple visual comparison of the developed film with standards gives sufficient accuracy for health safety.

3007

SILVER-ACTIVATED ALKALI HALIDES. H. W. Etzel, J. H. Schulman, R. J. Ginther, and E. W. Claffy. Phys. Rev. 85, 1063-4(1952) Mar. 15.

Emission spectra of AgCl-activated NaCl following absorption at 2095, 2170, and 2295 A are shown. The 2170-A absorption is apparently not due to pairs but to individual Ag ions, whereas the 2295-A absorption is caused by pairs. The absorption spectrum following x irradiation shows bands at 2760, 3050, and 3365 A as well as the F-band at 4620 A.

3008

THE NATURAL SCINTILLATIONS FROM URANYL NITRATE CRYSTALS. S. G. Cohen and Y. Feige. Phys. Rev. 85, 1049-50(1952) Mar. 15.

Scintillations were detected in unirradiated $UO_2(NO_3)_2 \cdot 6H_2O$ crystals with a photomultiplier. The scintillation rate was approximately that of the calculated disintegration rate of α particles from UI (U^{238}) and UII (U^{234}), indicating that the α particles on the average produce much larger scintillations than the β particles or secondary electrons from γ rays.

3009

TIN ACTIVATION OF LiI. James Schenck and R. L. Heath. Phys. Rev. 85, 923-4(1952) Mar. 1.

Pulse-height spectra for a LiI crystal containing ~0.1 mole % SnI_2 and exposed to slow neutrons or Cs^{137} γ rays are shown. The decay of fluorescence was exponential with 0.7-μsec time constant.

3010

THE RESPONSE OF ANTHRACENE SCINTILLATION CRYSTALS TO HIGH ENERGY μ MESONS. Theodore Bowen and Francis X. Roser. Phys. Rev. 85, 992-7(1952) Mar. 15.

The response of an anthracene scintillation counter to high-energy charged particles which lose only a small fraction of their energy intraversing the crystal was determined, using μ mesons in the cosmic radiation at sea level with energies from 29 Mev to greater than 1 bev. The light output was found to have a sizeable fluctuation for mesons of the same initial energy, due to ionization-loss straggling. The scintillation efficiency of the phosphor was found to decrease for increasing specific ionization in agreement with the work of others on electrons and protons. The response of the crystal showed no rise within 2% for relativistic meson energies, which agrees with calculations of the density effect reduction in ionization loss for anthracene. (auth)

3011

PARTICLE TRACKS IN NUCLEAR EMULSIONS. Arthur Beiser. Am. J. Phys. 20, 124-33(1952) Mar.

After a brief survey of the properties of nuclear emulsions, the production of tracks in them by ionizing particles is discussed. The various techniques in use for determining the charge, mass, and energy of the particles are reviewed, with the interpretation of grain density, track range, delta-rays, and multiple scattering measurements described. Lastly, consideration is given to auxiliary methods for neutron detec-

tion and the magnetic deflection of particles between emulsions. (auth)

3012

ON DISCRIMINATION BETWEEN STRONGLY IONIZING PARTICLES IN NUCLEAR PLATES. G. Belliboni and M. Merlin. Nuovo cimento (9) 8, 349-56(1951) May 1. (In Italian)

A method is examined for studying the nature and the energy distribution of highly ionizing particles by matching measurements of mean scattering deviation and gap-length density along the nuclear plate tracks. By using only one diagram, where the gap-length density for the "black" tracks as well as the grain density for the "gray" tracks are given vs. mean scattering deviation, it is possible to distinguish both high- and low-energy particles. The corrections to be taken into account because of fading also have been considered. (auth)

3013

ON THE VELOCITY OF MIGRATION OF ELECTRONS IN AN ARGON-ALCOHOL MIXTURE. A. Alberigi Quaranta, L. Mezzetti, E. Pancini, and G. Stoppini. Nuovo cimento (9) 8, 618-42(1951) Sept. 1. (In Italian)

A new experimental method for determining the transit time of the electrons in a G-M counter is described. Use is made of the results obtained with various experimental arrangements for the study of the dependence of the drift velocity upon the electric field strength. For values of E greater that 200 v/cm in a mixture of 90 mm Hg of A and 10 mm Hg of C_2H_5OH, the drift velocity turns out to be practically independent of the applied field, with a value of $(5.2 \pm 0.8) \times 10^6$ cm/sec. This conclusion is compared with the results obtained by other authors and is discussed qualitatively in terms of the different types of collisions which the electron undergoes with the molecules of the gaseous mixture. Some results are also given on the best operating conditions of G-M counters in experiments in which it is important to minimize the time lags due to the spread of the discharge along the central wire. (auth)

MESONS

3014

Rochester Univ.

THE ABSORPTION OF SLOW π^- MESONS BY He^3, by A. M. L. Messiah. Mar. 24, 1952. 29p. (NYO-3049)

A theoretical investigation of the absorption of π^- mesons by He^3 has been carried out in the impulse approximation, using the operators of the weak coupling theory. A similar calculation of π^- absorption in hydrogen and deuterium when compared with experiment fixes the constants in the theory. Consequently the branching ratios between the 6 competing absorption processes in He^3 can be predicted unambiguously. Comparison of these ratios and of the calculated γ-ray spectrum with experiment should provide a good test of the theory. (auth)

3015

New York Univ.

PROGRESS REPORT FOR THE PERIOD, NOVEMBER 1, 1950 TO SEPTEMBER 1, 1951, by M. H. Shamos. [nd] 73p. (NYO-3157)

The equipment and procedures for the following experiments are described: radiative transitions associated with the capture of negative μ mesons, energy dependence of the positive meson excess, measurements of the primary specific ionization of cosmic-ray mesons, and low-energy velocity selector. The following results are reported for the second-named experiment. The integral and differential time distributions of decay electrons from μ mesons stopped

in C and S under ~11 cm Pb have been measured. An analysis of the data by the statistical method of Peierls yields:

$$\tau^+ = \tau(\text{S-B}) = 2.09 \pm 0.05 \times 10^{-6} \text{ sec.}$$

$$\tau^- = \tau(\text{C-S}) = 1.92 \pm 0.04 \times 10^{-6} \text{ sec.}$$

$$\tau(\text{C-B}) = 2.06 \pm 0.03 \times 10^{-6} \text{ sec.}$$

The zero-time extrapolated intensities derived from the integral plot of the C and S data have been used to compute the μ^+/μ^- ratio as 1.06 ± 0.03 for the natural mixture of the sea-level μ mesons at a momentum of 250 Mev/c.

3016

Rochester Univ.

DECAY OF A NEUTRAL SCALAR HEAVY MESON, by H. P. Noyes. Mar. 31, 1952. 21p. (NYO-3207)

The decay of a neutral scalar heavy meson into two pseudoscalar π mesons is renormalized by the introduction of a contact interaction $\chi \Phi_s \Psi_{ps}^* \Psi_{ps}(X)$, where the finite part of χ is an empirical constant chosen to fit the observed lifetime for this decay. This interaction contributes to the decay into two γ rays in order $G_s g_{ps}^2 e^2$, and all contributions to this order have been calculated. The total fifth-order contribution is negative relative to the third-order matrix element. Consequently, for a particular relationship between the heavy and light meson coupling constants, the two γ decay lifetime will be e^2/g^2 slower than the two-π decay lifetime. Hence, heavy scalar mesons strongly enough coupled to nucleons to be produced copiously at high energies could be sufficiently stable to be observed experimentally; in particular the V_2^0 particle may be of this type. (auth)

3017

THE RENORMALIZED S-MATRIX FOR MESON INTERACTIONS. Paul Taunton Matthews. Ph.D. Thesis, Univ. of Cambridge, 1950.

A new derivation is given of the generalized Schrödinger equation in the interaction representation of Tomonaga and Schwinger. This is applied to the interactions of mesons and nucleons, and the meson and nucleon self-energies are calculated to the second order for scalar and vector mesons with both types of coupling. It is shown that these can be removed by mass renormalization. The S-matrix is derived for any meson interaction by the Feynman-Dyson invariant perturbation theory. This is of obviously invariant form and the introduction of general space-like surfaces is not necessary for this result. The possible types of primitive divergents are considered for all meson interactions. For interactions involving the canonical momenta of the field variables, the number of possible types is unlimited. For those not involving the canonical momenta, the number of types is always strictly limited. The divergences can be removed to any order by mass and 'charge' renormalization for neutral vector mesons. The divergences can certainly be removed to the eighth order for charged (pseudo-, scalar mesons with scalar interaction, and also for these mesons in the electromagnetic field, in the same way, provided also a direct interaction between mesons is introduced. The possible extension of this procedure to any order and to the combined interaction of charged (pseudo-) scalar mesons with nucleons in the electromagnetic field is discussed. The latter problem is shown to be very similar in principle to that of any two of the component interacting fields. (auth)

3018

RADIATIVE $\pi - \mu$ DECAY. Tetsuo Eguchi. Phys. Rev. 85, 943-4(1952) Mar. 1.

The probabilities of radiationless and radiative $\pi \to \mu$ decay were calculated by a relativistic second-order perturbation method. Integrating the μ-meson distribution from 0

to 3.5 Mev gave the value 1.3×10^{-4} for the ratio of photon-emitting decay to normal decay, not inconsistent with experiment. The probability for getting a photon with energy more than 1 Mev is 3×10^{-4} per ordinary decay. The average photon energy per decay is 12 kev.

3019

TOTAL CROSS SECTIONS OF POSITIVE PIONS IN HYDROGEN. H. L. Anderson, E. Fermi, E. A. Long, and D. E. Nagle. Phys. Rev. 85, 936(1952) Mar. 1.

The following total cross sections of positive π mesons in liquid H_2 were measured:

Energy (Mev)	Cross section (10^{-27}cm^2)
56 ± 8	20 ± 10
82 ± 7	50 ± 13
118 ± 6	91 ± 6
136 ± 6	152 ± 14

The experimental data on scattering of positive and negative π mesons are compatible with the general assumption that the dominant interaction is through one or more intermediate states of isotopic spin $\frac{3}{2}$, regardless of the resonance-level spin. The nature of the intermediate states is discussed briefly.

3020

ORDINARY AND EXCHANGE SCATTERING OF NEGATIVE PIONS BY HYDROGEN. E. Fermi, H. L. Anderson, A. Lundby, D. E. Nagle, and G. B. Yodh. Phys. Rev. 85, 935-6 (1952) Mar. 1.

An attempt has been made to distinguish between the $p + \pi^- \to p + \pi^-$ and $p + \pi^- \to n + \pi^0 \to n + 2\gamma$ processes in the scattering of 118-Mev negative mesons by liquid H_2. The coincidence arrangement is described, and typical data are tabulated. On the assumption that the angular distribution is fairly isotropic in the center-of-mass system and that the γ rays are produced in pairs by the decay of the neutral pions, the cross sections for the processes would be $10 \pm 4 \times 10^{-27}$ and $20 \pm 5 \times 10^{-27}$ cm^2, respectively. The cross section for the charge-exchange process would be $29 \pm 7 \times 10^{-27}$ cm^2 for a $\cos^2\theta$ distribution and $18 \pm 4 \times 10^{-27}$ cm^2 for a $\sin^2\theta$ distribution.

3021

TOTAL CROSS SECTIONS OF NEGATIVE PIONS IN HYDROGEN. H. L. Anderson, E. Fermi, E. A. Long, R. Martin, and D. E. Nagle. Phys. Rev. 85, 934-5(1952) Mar. 1.

Negative π mesons of 80- to 230-Mev energy were produced by 450-Mev proton bombardment of Be or Cu, and the following data for the total cross section in liquid H_2 were determined. The cross section is seen to rise rather rapidly above 80 Mev until it reaches the "geometrical" value $\pi(\hbar/\mu c)^2$ at 150 Mev, where it seems to level off or perhaps to go through a maximum. The measurements do not permit a decision between these two possibilities.

Energy band Mev	Cross section 10^{-27}cm^2
89 ± 8	21 ± 8
112 ± 6	31 ± 9
135 ± 6	52 ± 6
176 ± 6	66 ± 6
217 ± 6	60 ± 6

3022

THE IONIZATION LOSS OF ENERGY OF RELATIVISTIC MU-MESONS IN ARGON. J. E. Kupperian, Jr. and E. D. Palmatier. Phys. Rev. 85, 1043(1952) Mar. 15.

The variation with energy of the ionization loss of 160- to 1800-Mev cosmic-ray μ mesons in Pb has been studied in proportional counters filled to 1.6 atm. with 97% A and 3% CO_2. The Bethe, Bloch, and Williams theory of energy loss, as extended by Landau to account for fluctuations in the energy loss, predicts quite accurately the observed rise with increasing energy.

3023

"INFRA-RED CATASTROPHE"-LIKE DIVERGENCY IN MESON-DECAY PROCESS. D. Itô. Progress Theoret. Phys. (Japan) 6, 1020-2(1951) Nov.-Dec.

Asymptotic forms and reciprocity relations are derived which show that the "Infra-red catastrophye"-like divergences in the meson decay process can be cancelled out by simultaneous consideration of the processes of elastic scattering and of decay with double scattering.

3024

ON THE Z-DEPENDENCE OF THE POSITIVE-NEGATIVE RATIO OF THE MESONS PRODUCED BY PHOTONS ON NUCLEI. S. Machida and T. Tamura. Progress Theoret. Phys. (Japan) 6, 1030-2(1951) Nov.-Dec.

Symmetrical nuclei are treated as a group of α clusters and asymmetrical nuclei are treated as a group of α clusters plus zero, one, or two neutrons or protons in the calculation of the Z dependence on the production of positive or negative π mesons. It is also assumed that the binding energy of the α cluster is such that the recoil energy is divided uniformly among all nucleons within the α cluster. Thus, when the nuclei are bombarded by x rays, the four nucleons of an α cluster will all be in excited states or some of the nucleons might be knocked out the α cluster. The probability, after bombardment, for protons being in the nucleus is reduced compared to that of neutrons by the effect of the coulomb potential barrier. This reduction of the probability for the final state is more effective in the case of π^--meson production than for π^+, since in the final state there are three protons and one neutron for the former case compared to one proton and three neutrons for the latter. The results are compared with the experimental results of Littauer and Walker (Phys. Rev. 82, 746(1951)) and excellent agreement is obtained.

3025

ON THE SHORT μ-MESON TRACKS FROM π-MESON DE-CAYS. T. Nakano, J. Nishimura, and Y. Yamaguchi. Progress Theoret. Phys. (Japan) 6, 1028-9(1951) Nov.-Dec.

The following modes of $\pi-\mu$ meson decay schemes are discussed

$$(1) \quad \pi^\pm \to \mu^\pm + \nu^0$$

$$(2) \quad \pi^\pm \to \mu^\pm + \mu^0$$

$$(3) \quad \pi^\pm \to \mu^\pm + \mu_1^0 + \mu_2^0$$

$$(4) \quad \pi^\pm \to \mu^\pm + \nu^0 + \gamma$$

Assuming direct coupling between pseudoscalar π-meson field and spin ½ field, the probability of (2) relative to (1) was found by the Feynman-Dyson method. The energy distribution of the μ meson is also calculated and graphed.

3026

MESON-NUCLEON SCATTERING. Yoichiro Nambu and Yoshio Yamaguchi. Progress Theoret. Phys. (Japan) 6, 1000-6(1951) Nov.-Dec.

The relationships between various modes of meson-nucleon scattering are derived using the symmetry properties of the space charge. The connection between the present formalism and meson theories is also given.

3027

THE PHENOMENOLOGICAL ANALYSES OF MESONIC PROCESSES. Yoshio Yamaguchi. Progress Theoret. Phys. (Japan) 6, 772-87(1951) Sept.-Oct.

A phenomenological discussion is presented of available data on the following processes involving artificially produced π mesons: photomeson production from nucleons and deuterons, scattering of mesons by nucleons, meson production by nucleon-nucleon collision, and slow π^--meson capture by H and D.

3028

A NOTE ON THE FERMI'S THEORY OF MESON PRODUC-TION. Y. Fujimoto and T. Tamura. Progress Theoret. Phys. (Japan) 6, 910-3(1951) Sept.-Oct.

Calculations are made of the number of charged mesons produced in nucleon-nucleon collision by protons in the energy regions 1 to 5 bev and >14 bev, interpolating for values between. Comparison is made to experimental data of Salent (Phys. Rev. 79, 184(1950)) with the result that all calculated values are found too small. The possible reasons for the differences are discussed.

3029

PRODUCTION OF CHARGED π-MESON BY γ-RAY; HIGHER ORDER CORRECTIONS. Ziro Koba, Tsuneyuki Kotani, and Shinzo Nakai. Progress Theoret. Phys. (Japan) 6, 849-88 (1951) Sept.-Nov.

The effective cross section for the production of charged π meson by γ ray is calculated by the Lorentz covariant perturbation method, including the effects of order $e^2 f^4$ ($e^2 g^4$). The pseudoscalar meson field with both pseudoscalar and pseudovector coupling has been employed. Virtual mesons in intermediate states can be either charged or neutral. The procedure of the renormalization of mass and mesic charge (f,g) is sufficient to determine unambiguously the finite 4th-order matrix element except only one term to be interpreted as "electric charge of neutron," which is struck out. The general requirement of gage invariance restricts the possible interaction of nucleon and meson with a photon to only four types; consequently numerous Dyson diagrams have been divided into certain gage invariant classes and then reduced, according to Dyson's general program, to obtain ultimately those four types. In the second approximation the anomalous magnetic moment of the nucleon plays an essential part; consequently the lack of any correct analysis for the latter complicates the results considerably. Moreover, in the $\gamma-\pi$ process the behavior of the magnetic corrections, dependent on the incident energy of photon, are comparable with the static effects. Three provisional measures have been taken with regard to the anomalous moments and the resulting values for the various combinations and couplings of meson fields are compared and discussed. Though the results depend upon the choice of these possibilities, it is shown, in general, that the 4th-order contributions turn out for the energy region of the present experiments (incident x ray being about 330 Mev) not so large compared with the 2nd order in the case of the symmetrical combination, while they are of the same order of magnitude with the 2nd order in the case of the "charged plus pure neutral" combination. Finally some qualitative aspects of the $\gamma-\pi$ process are discussed, which might be valid independently of the order of approximation. (auth)

3030

π^0-MESON PRODUCTION BY GAMMA-RAY. S. Minami. Progress Theoret. Phys. (Japan) 6, 895-6(1951) Sept.-Oct.

The higher orders in symmetrical and neutral pseudoscalar theory have been calculated for the process of $P + \gamma \to P + \pi^0$ in order to eliminate the disagreement between the experimental measurement and calculations for the lowest-order perturbation theory. The results, though not complete, show promise of eliminating this disagreement.

3031

NUCLEAR INTERACTION OF μ-MESON. Hiroshi Fukuda, Yoichi Fujimoto, and Masatoshi Koshiba. Progress Theoret. Phys. (Japan) 6, 788-800(1951) Sept.-Oct.

The experimental results obtained by George and Evans (Proc. Phys. Soc. (London) 63, 1248(1950)) concerning nuclear events in underground cosmic radiation were found to be in good agreement with the theoretical calculation, when the electromagnetic interaction of the μ meson and nucleon was treated by the Feynman-Dyson procedure.

3032

ON THE SELF-ENERGIES OF MESONS. Kazuo Yamazaki and Hiroshi Enatsu. Progress Theoret. Phys. (Japan) 6, 731-6(1951) Sept.-Oct.

Self-energies of mesons are investigated by making use of the method of mixing meson fields. The calculations are performed by taking into account the effects of the surface integrals. In the present case the surface terms will not contain any diverging integral, so that the divergent parts will provide the same form as that which could be derived by making use of the Schwinger's method. As to the surface terms themselves, the contributions which arise from the third and higher derivatives vanish entirely in the case of the boson field. It is concluded that if the pseudoscalar theory is assumed for π mesons, all the divergencies of the self-energies of the mesons due to the fermion field cannot be removed by the procedure of mixing various fermion fields.

3033

PHOTOMESON PRODUCTION IN CARBON AND HYDROGEN. B. T. Feld, D. H. Frisch, I. L. Lebow, L. S. Osborne, and J. S. Clark. Phys. Rev. 85, 680-1(1952) Feb. 15.

Cylindrical targets of paraffin, heavy paraffin, and graphite were exposed simultaneously to the x-ray spectrum produced by 330-Mev electrons in the M.I.T. synchrotron. The energy distributions of photomesons from C and H were obtained at angles of 90 and 26° to the photon beam. The mesons were slowed down in brass blocks, and the ends of their tracks were observed in photographic emulsions embedded radially in blocks. The number of positive mesons per proton in C as compared to H, averaged over the energy ranges, is 0.32 ± 0.05 at 90° and 0.07 ± 0.01 at 26°. The negative-positive ratio from C shows no strong dependence on meson energy and has the average value of 1.43 ± 0.13 at 90° and 1.03 ± 0.25 at 26°. Experimental cross sections for H are plotted vs. photon energy and compared with predictions of pseudoscalar theory. For the range $h\nu = 210$ to 305 Mev, the ratio of average cross sections $\sigma(34°)/\sigma(107°) = 0.80 \pm 0.18$.

3034

IS THERE A NEUTRAL μ-MESON? G. E. Uhlenbeck and C. S. Wang Chang. Phys. Rev. 85, 684(1952) Feb. 15.

The recent experiments of Sagane, Gardner, and Hubbard (Phys. Rev. 82, 557(1951)) on the continuous β spectrum in the μ^- decay seem to indicate that the spectrum goes to zero at the upper limit (53 ± 2 Mev). It is pointed out that the usually accepted decay scheme $\mu^\pm \to e^\pm + 2\nu$ requires a special form of the β interaction between the four spinor fields for the spectrum to go to zero at the upper limit, and that the simplest explanation of this zero value may be to assume that the μ^- decays into a neutral meson of finite mass ($\sim 40m$), an electron, and a neutrino. If there is a triad of μ mesons, the reaction $\pi^0 \to \mu^0 + \nu$ should occur with the same coupling constant as the reactions $\pi^\pm \to \mu^\pm + \nu$. It could presumably, therefore, not compete with the decay of the π^0 meson into two γ rays, but it would have as a consequence that the μ^0 meson could decay into a neutrino and two photons. The lifetime would be of the order of 10^{-9} sec, and the photons would be rather soft.

3035

ON THE SELF-ENERGIES OF NUCLEONS. Hiroshi Enatsu. Progress Theoret. Phys. (Japan) 6, 643-64(1951) Sept.-Nov.

The second-order self-energies of nucleons are evaluated by making use of the recent covariant formalism. If the symmetrical pseudoscalar type with pseudovector coupling is assumed for the π meson, it is shown that, in order to cancel divergences of self-energies of nucleons due to π mesons, it is necessary to introduce heavy mesons which obey the symmetrical scalar field with vector coupling. Their coupling constants are larger than those of π mesons, and their masses are 1474 m_e. (auth)

3036

THE SCATTERING OF MESONS BY NUCLEAR PARTICLES, I. R. C. Majumdar, A. S. Apte, and M. K. Sundaresan. Progress Theoret. Phys. (Japan) 6, 737-47(1951) Sept.-Oct.

A general relativistic theory of scattering of mesons including radiation damping has been worked out in which the incident pseudoscalar (vector) meson is scattered by nuclear particles into a pseudoscalar or a vector meson. The cross-sections for the scattering processes involving charged mesons only are given and it is shown that the integral equation of the radiation damping can be solved exactly in a very simple way. (auth)

3037

ENERGY SPECTRUM OF μ MESONS ARISING FROM DISINTEGRATION OF κ MESONS. Louis Michel and Raymond Stora. Compt. rend. 234, 1257-9(1952) Mar. 17. (In French)

Assuming that the 1200-m_e κ meson decays into a μ meson and two neutrinos, that the interaction between the four fermions is direct, and that the κ meson has a spin of $\frac{1}{2}$, the author calculates energy spectra for the μ secondaries and half lives for the κ mesons for various coupling constants and for κ-meson masses of 1080, 1200, and 1320 m_e. Experimental evidence suggests that the reaction is the same type as $\kappa \to e + 2\nu$ and that competition is possible. The half life of the κ meson is between 10^{-10} and 10^{-9} sec.

3038

ON COLLISION OF π MESONS WITH DEUTERONS. V. B. Berestetskiĭ and I. Ya. Pomeranchuk. Doklady Akad. Nauk S.S.S.R. 81, 1019-21(1951). (In Russian)

Equations for cross sections of elastic and inelastic scattering of π mesons by deuterons are derived on the assumptions of zero spin and scalar amplitudes.

3039

PROTON-ANTIPROTON ANNIHILATION WITH EMISSION OF NEUTRAL AND CHARGED VECTOR MESONS. R. S. Liotta. Nuovo cimento (9) 8, 857-73(1951) Nov. 1. (In Italian)

The probability of proton-antiproton annihilation into two charged or neutral vector mesons has been studied. The cross section for meson production behaves as $1/(\gamma - 1)$ for $\gamma \to 1$ (γ being the energy of the negative proton divided by its rest energy in the system where the positive proton is at rest), while for $\gamma \to \infty$ the longitudinal part becomes infinite and the transversal part infinitesimal. For an energy of the negative proton of 2 bev the cross section is $\sim 10^{-28}$ cm² for emission of neutral mesons and $\sim 10^{-26}$ cm² for charged mesons. (auth)

3040

PHOTOPRODUCTION OF MESONS IN DEUTERIUM. G. Morpurgo. Nuovo cimento (9) 8, 552-68(1951) Aug. 1. (In Italian)

The effect of binding and particularly of Pauli's principle in the photoproduction of mesons in D has been studied in a way which is independent of a detailed meson theory. This is possible by considering not the total cross section but only the ratio between the cross section for photoproduction in D and H. For photons of 300 Mev Pauli's principle considerably reduces the cross section for photoproduction at

small angles (down to ~ 25°) if the probability γ^2 that the spin of one of the nucleons is not flipped during the process is 1. On the contrary the effect of Pauli's principle is unimportant if the probability of flipping is 1. It is hoped on the basis of these results that experiments might decide between a large or small probability of flipping, so confirming the results of Panofsky et al. (Phys. Rev. 81, 565(1951)) on the nonradiative absorption of mesons in D. (auth)

METEOROLOGY

3041
Massachusetts Inst. of Tech.
RESEARCH ON TURBULENCE AND DIFFUSION OF PARTICULATE MATTER IN THE LOWER LAYERS OF THE ATMOSPHERE, by E. Wendell Hewson. Aug. 10, 1951. 42p. (NP-3701; Progress Report No. 11)

Design and performance of a fast-response bi-vane are described. Completion of a wind tunnel for calibrating micrometeorological instruments is reported and details of construction and operation are discussed. Progress is reported in studies of the physical aspects of atmospheric diffusion and of eddy motion in the lower layers of the atmosphere. Comments on the symposium on atmospheric turbulence in the boundary layer, held at M.I.T. on June 4, 1951, are included.

MOLECULAR PROPERTIES

3042
Johns Hopkins Univ.
THE $3p^3\ 2s^3$ BANDS OF TH AND $T_{\frac{1}{2}}^{1}$, by G. H. Dieke and B. S. Tomkins. Johns Hopkins Univ. and Argonne National Lab. July 30, 1950. 47p. (NYO-530)

This material appeared in Phys. Rev. 82, 796-807(1951) and was abstracted in Nuclear Science Abstracts as NSA 5-4837.

3043
THE USE OF ISOTOPIC MOLECULES FOR THE COMPLETE DETERMINATION OF FORCE CONSTANTS. I. LINEAR MOLECULES. J. C. Decius. J. Chem. Phys. 20, 511-16 (1952) Mar.

Equations are developed which show the maximum amount of information which can be obtained concerning the force constants with isotopic linear molecules. It is demonstrated that a unique solution can be found in terms of the expressions $\Sigma_k \lambda_k$, $\Sigma_k \lambda_k^2$, and $\Sigma_k \lambda_k^3$, where $\lambda_k = 4\pi^2 \nu_k^2$, provided in ν_k are known for the "unsubstituted" molecule and for certain isotopic molecules involving respectively single, double, and triple substitutions; i.e., if ABCD $\cdots$ is the unsubstituted molecule, isotopic molecules of the types A*BCD $\cdots$, AB*CD $\cdots$, etc., A*B*CD $\cdots$, etc., and A*B*C*D $\cdots$, etc., are required. More than two isotopic forms (such as A and A*) of any given atom are not required. For the triatomic molecule, only the singly substituted forms are required (this is also true for the perpendicular vibrations of the tetratomic molecule). It is also found that the force constants of the symmetrical linear molecule may be found using only symmetrical isotopic molecules; the number of these required is naturally less than the number required for an unsymmetrical molecule having the same number of atoms. (auth)

NEUTRONS

3044
Los Alamos Scientific Lab.
THE TWO-PLATE METHOD OF MEASURING FAST NEUTRON ENERGY SPECTRA WHEN THE DIRECTION OF THE INCIDENT NEUTRONS CANNOT BE DETERMINED, by John E. Evans. Apr. 17, 1952. 26p. (LAMS-1312)

A method is suggested for measuring anisotropic fast neutron spectra by exposing two nuclear plates in planes at right angles to each other. Spectra can be measured in the energy range from 500 kev to about 4.1 Mev. As an experimental check of the method, a set of two plates was exposed to two groups of monoenergetic neutrons about 500 kev apart. The plates were rotated during exposure to simulate an anisotropic neutron flux. 1050 tracks were measured and the resulting spectra are given. (auth)

3045
THE TETRANEUTRON. K.-H. Sun, F. A. Pecjak, and A. J. Allen. Phys. Rev. 85, 942-3(1952) Mar. 1.

If it is assumed that the tetraneutron is β unstable with respect to He, but stable with respect to free neutrons, the maximum binding energy of n^4 would be 14 Mev. Attempts to detect the $Rh^{103}(n,4n)Rh^{100}$ and $Bi^{209}(n,4n)Bi^{206}$ reactions using neutrons of 18-Mev maximum energy were unsuccessful, indicating a binding energy for n^4 below 3 Mev or extremely small yield. It is suggested that detection of a monoenergetic recoil group from the reaction $Bi^{209} + H^1 \rightarrow Po^{206} + n^4$ would be a direct proof of the existence of the tetraneutron.

NUCLEAR PHYSICS

3046
A PROPOSED TEST OF THE NUCLEAR SHELL MODEL. H. A. Bethe and S. T. Butler. Phys. Rev. 85, 1045-6(1952) Mar. 15.

Information on angular distributions in the following stripping reactions would, if available, give direct evidence of the accuracy of the independent-particle model of nuclear structure in assigning orbital angular momentum states to nucleons. In order that there be appreciable separation between the peaks of interest, the most favorable incident deuteron energy is probably about 10 to 15 Mev.

Reaction	Spin and parity Initial	Spin and parity Final	l Required by shell model	l Allowed values
$P^{31}(d,p)P^{32}$	$\frac{1}{2}+$	$1+$	2	0 and 2
$Cl^{35}(d,p)Cl^{36}$	$\frac{3}{2}+$	$2+$	2	0, 2, and 4
$Cl^{37}(d,p)Cl^{38}$	$\frac{3}{2}+$	$2-$	3	1 and 3
$K^{41}(d,p)K^{42}$	$\frac{3}{2}+$	$2-$	3	1 and 3
$Sc^{45}(d,p)Sc^{46}$	$\frac{7}{2}-$	$4+$	3	1, 3, 5, and 7
$V^{51}(d,p)V^{52}$	$\frac{7}{2}-$	2 or 3+	3	1, 3, 5 (and 7)

3047
MAGIC NUMBERS AND THE ISOTOPE SHIFT IN ATOMIC SPECTRA OF HEAVY ELEMENTS. P. Brix and H. Kopfermann. Phys. Rev. 85, 1050-1(1952) Mar. 15.

Experimental isotope shifts divided by those calculated from Breit's theory of the nuclear volume effect are plotted as a function of the neutron number N from N = 50 to N = 130. Rises at the magic numbers 82 and 126 are clearly shown.

3048
A TEST FOR THE CHARGE-SYMMETRY HYPOTHESIS. Richard L. Garwin. Phys. Rev. 85, 1045(1952) Mar. 15.

The reactions $p + d \rightarrow d + n + \pi^+$ and $p + d \rightarrow d + p + \pi^0$ are suggested as experimental tests of the charge-symmetry hypothesis in the coupling of mesons to nucleons. These reactions are the two possible breakups of a proton catalyzed by the presence of the deuteron which absorbs the extra momentum. A particular advantage is that the interaction of mesons is measured in states of total isotopic spin $\frac{1}{2}$.

3049
THE CLOSING OF THE PROTON SUB-SHELL AT Z 58. G. P. Dube and S. Jha. Phys. Rev. 85, 1042-3(1952) Mar. 15.

The following binding energies of the last proton have been estimated from known β-decay and neutron-binding

energies. The sudden drop in energy for the 59th proton is strong evidence that there is a completion of the proton subshell $1g_{7/2}$ at $Z = 58$ making Ce^{140} a doubly magic isotope.

$$_{57}La^{137,138} \sim 7 \text{ Mev}$$

$$_{58}Ce^{140,142} \sim 8$$

$$_{59}Pr^{140,142} \sim 4.5 \text{ and } 6, \text{ respectively}$$

$$_{60}Nd^{141} \sim 7$$

3050

ON THE RELATIVISTIC THEORY OF NUCLEAR FORCES. III. RELATIVISTIC CORRECTIONS TO THE INTERACTION PRODUCED BY A SCALAR FIELD. Maurice Lévy. Compt. rend. 234, 1255-7(1952) Mar. 17. (In French)

The formalism described in parts I and II is used to calculate the relativistic corrections of the v/c and $(v/c)^2$ order for the interaction between two nucleons produced by neutral or symmetrically charged scalar fields.

3051

THE CONCEPT OF VIRTUAL LEVELS IN THE THEORY OF ELASTIC SCATTERING OF NEUTRONS BY ATOMIC NUCLEI. Otto Bergmann. Acta Phys. Aust. 5, 240-53 (1951) Dec. (In German)

An expression for the cross section of neutron scattering by protons is derived, and successive approximations are used to calculate the potential-well dimensions of the ^1S and ^3S states of virtual levels of the n-p system.

NUCLEAR PROPERTIES

3052

Wyoming Univ.

NUCLEAR MAGNETIC RESONANCE PROJECT; PROGRESS REPORT JULY 1, 1950 TO MARCH 15, 1951. [nd] 32p. (AECU-1946)

The equipment and procedure for measuring nuclear magnetic resonance are described. Preliminary results are given for the paramagnetic salts $Fe(NO_3)_3$ and $MnSO_4$. The results for $Fe(NO_3)_3$ are in excellent agreement with the results reported by Purcell (Phys. Rev. 73, 679(1948)).

3053

Los Alamos Scientific Lab.

VELOCITIES OF FRAGMENTS FROM FISSION OF U^{233}, U^{235} AND Pu^{239}, by R. B. Leachman. [nd] Decl. Mar. 26, 1952. 16p. (AECD-3347; LADC-1058(Rev.))

The velocity distributions of fragments from slow-neutron induced fission have been measured by a time-of-flight method. When compared with data from fission fragments stopped in ionization chambers filled with argon and carbon dioxide, these velocity data indicate that the kinetic energies of the fragments exceed those reported by ionization chamber measurements by 5.7 Mev for the most probable light fragment and by 6.7 Mev for the most probable heavy fragment. These energy differences for the most probable light and heavy fragments can be explained by energy-ionization ratios which exceed by 6 percent and 11 percent, respectively, the alpha-particle energy-ionization ratio on which the energies from ionization chamber measurements are based. The average kinetic energy of fission fragments determined from velocities is shown to be in good agreement with calorimeter results and the energy calculated from recent mass spectrographic data. The widths of the peaks of the directly measured velocity distribution, for which the resolution is known, are appreciably narrower than those calculated from ionization chamber data. These differences in width are used to estimate the resolution of ionization chamber measurements of fission fragment energies. (auth) (cf. AECD-3267; NSA 5-7251)

3054

Wesleyan Univ., Middletown

SOME NEW VALUES OF ATOMIC MASSES, PRINCIPALLY

IN THE REGION OF 82 NEUTRONS, by H. E. Duckworth, Cort L. Kegley, John M. Olson and George S. Stanford. May 30, 1951. 17p. (NYO-680)

This material appeared in Phys. Rev. 83, 1114-17(1951) and was abstracted in Nuclear Science Abstracts as NSA 5-7337.

3055

Wesleyan Univ., Middletown

EVIDENCE FOR MAGIC NUMBERS FROM SOME RECENT ATOMIC MASS MEASUREMENTS, by Henry E. Duckworth and Richard S. Preston. Nov. 20, 1950. 28p. (NYO-678)

Mass spectrographic measurements are described which lead to mass values for Ti^{48}, Sr^{86}, Sr^{88}, Mo^{98}, Sn^{117}, Sn^{120}, Pt^{194}, Pt^{196} and Pb^{208}. These masses plus some previously reported ones are combined with appropriate disintegration data to compile a table of mass values for 70 of the heavier nuclides. It is shown that there is an unequivocal mass effect associated with the 50-neutron configuration and some mass evidence in support of the magic numbers 14, 16, 28, 32, and 40. Doubly magic nuclides are suggested as marking major transition points in the packing fraction curve. (auth)

3056

RADIOACTIVITY IN THE CADMIUM REGION: PRESENT EXPERIMENTAL STATUS OF (α, T) REACTIONS AND RELATIVE CROSS SECTION MEASUREMENTS FOR DEUTERON INDUCED REACTIONS. Eugene Cobb Mallary. Ph.D. Thesis, Ohio State Univ., 1950.

The following isotopes have been produced by α, d, or n bombardment of cadmium isotopes: In^{107}, In^{109}, In^{108}, In^{111}, In^{114}, Ag^{104}, Ag^{111}, Ag^{114}, Sn^{108}, Sn^{117}, and Cd^{107}. Possible decay scheme for these are given. By use of a rapidly rotating target probe in the cyclotron, different thick targets were subjected to identical dueteron bombardments. The relative cross sections of many reactions producing the above-named isotopes were measured. The results indicate a general trend for the (d,p) cross section to decrease exponentially with increasing atomic number, but there is some variation from this tendency for neighboring element.

3057

THE PURE NUCLEAR ELECTRIC QUADRUPOLE RESONANCE OF N^{14} IN THREE MOLECULAR SOLIDS. G. D. Watkins and R. V. Pound. Phys. Rev. 85, 1062(1952) Mar. 15.

The pure quadrupole resonance frequencies and relaxation times of N^{14} were measured in solid ICN, BrCN, and $(CH_2)_6N_4$ at -196, -74, and $0°C$ and at room temperatures. Relaxation times also were determined.

3058

RELATIVISTIC EFFECTS IN NUCLEON-NUCLEON SCATTERING. Spencer Macy. Ph.D. Thesis, Iowa State Coll., 1951.

A theoretical investigation into the relativistic corrections that must be added to the nucleon-nucleon scattering cross section is given. The nucleons were treated as Dirac particles, and the Dirac equations for the two-nucleon system with an interaction potential were used. Since a potential function with a finite range was desired, it was necessary to add to the hamiltonian a term which adds nothing to the potential in the first approximation, but which made the expectation value of the potential invariant to the second order in v/c under a Lorentz transformation. An application of the theory was made to the problem of neutron-proton scattering at 100 Mev. It was found that the correction to the total cross section from the odd states was of a higher order than for the even states, so that the symmetry about 90° was unchanged. The total cross section could be increased or decreased by 5 to 10% depending on which of the four possible potentials was chosen. A decrease of this amount would bring the theoretical value into agreement with the experimental.

3059

THE GYROMAGNETIC RATIOS OF Li^7, Na^{23}, Al^{27}, and P^{31}. T. Kanda, Y. Masuda, R. Kusaka, Y. Yamagata, and J. Itoh. Phys. Rev. 85, 938(1952) Mar. 1.

The following gyromagnetic ratios, relative to that of the proton, were measured by a magnetic-resonance method. Diamagnetic corrections were not applied. The errors are maximum, i.e., about three times the probable errors.

Li^7	0.388637 ± 0.000010
Na^{23}	0.264514 ± 0.000009
Al^{27}	0.260579 ± 0.000008
P^{31}	0.404804 ± 0.000010

3060

AN ATTEMPT TO PRODUCE NUCLEAR ORIENTATION IN MERCURY VAPOR. Francis Bitter and Jean Brossel. Phys. Rev. 85, 1051(1952) Mar. 15.

An enriched sample of Hg^{199} was placed in a quartz resonance lamp in a magnetic field of a few hundred gauss and illuminated by circularly polarized resonance radiation incident in a direction parallel to the field. An r-f field of such frequency as to induce transitions between the ground-state magnetic sublevels was applied to the resonance lamp. If an appreciable degree of preferred nuclear orientation were produced, the intensity of the π component of the resonance radiation with $\Delta m = 0$ would be less than for a disoriented vapor because fewer atoms would be in the $m = -\frac{1}{2}$ ground level. No such effects were observed.

3061

MASSES OF Pb^{208}, Th^{232}, U^{234}, U^{235}, and U^{238}. George S. Stanford, Henry E. Duckworth, Benjamin G. Hogg, and James S. Geiger. Phys. Rev. 85, 1039(1952) Mar. 15.

The masses of Pb^{208}, Th^{232}, U^{234}, and U^{238} were determined mass-spectrographically and adjusted with disintegration data to give the mutually consistent values 208.0416 ± 0.0010, 232.1093 ± 0.0010, 234.1129 ± 0.0010, and 238.1241 ± 0.0010 amu, respectively. The mass of U^{235} was calculated from that of Th^{232} to be 235.1156 ± 0.0010 amu.

3062

THE MAGNETIC MOMENT OF Zn^{67}. S. S. Dharmatti and H. E. Weaver, Jr. Phys. Rev. 85, 927(1952) Mar. 1.

Nuclear-induction measurements in $Zn(NH_3)_4^{++}$, $ZnCl_2$, $ZnSO_4$, and $ZnNO_3$ solutions proved that the spin of Zn^{67} is $\frac{5}{2}$ and gave the value $+0.87378 \pm 0.00013$ for the magnetic moment.

3063

ON THE QUADRUPOLE MOMENTS OF LIGHT NUCLEI. Hisashi Horie and Shirô Yoshida. Progress Theoret. Phys. (Japan) 6, 829-36(1951) Sept.-Oct. .

Values are calculated assuming the usual shell model for the quadrupole moments of light nuclei. Unsatisfactory agreement with experimental values was found except for the nuclei which had one nucleon outside a closed shell. The calculations revealed that a configuration interaction is necessary from the standpoint of the j-j coupling shell model, in order to obtain consistent values of quadrupole and magnetic moments of light nuclei.

3064

ATOMIC SPECTROSCOPY AND SEPARATED ISOTOPES. J. R. McNally, Jr. Am. J. Phys. 20, 152-60(1952) Mar.

The advantages in the use of separated isotopes in atomic spectroscopy for the determination of nuclear moments I, μ, Q, and for studies of the isotope-shift phenomena are discussed. Illustrations of spectra are given for mercury, uranium, and samarium. In addition, a summary is given of twenty-two so-called problem nuclei, i.e., those naturally occurring isotopes for which the nuclear moments are completely uncertain. Concluding remarks are made on such problems as the evaluation of the absolute magnitude of isotope shifts, the role of "forbidden transitions" in isotope

spectra, and the potential future value of spectro-isotopic assay techniques. (auth)

3065

BINDING ENERGIES FOR ELECTRONS OF DIFFERENT TYPES. Charlotte E. Moore and Henry Norris Russell. J. Research Natl. Bur. Standards 48, 61-7(1952) Jan.

The binding energy of an electron of given type in any state of a neutral or ionized atom may be defined as that required to remove it along successive terms of a spectral series to its limit. The data regarding electron configurations and limits collected in Atomic Energy Levels (NBS Circular 467 I(1949); II(1952)) permit the calculation of these in a great number of cases. The present tables give the maximum energy resulting from the addition of an electron of given type (such as 4p) to the ground states of singly or doubly ionized atoms of the elements H through Nb; and, when desirable, to one other low state (two in the cases of Sc and Y). These increase smoothly with atomic number except for a remarkable break after a shell of ten d-electrons has been half filled.

3066

DEVIATIONS OF NUCLEAR MOMENTS FROM THE SCHMIDT LINES. Hironari Miyazawa. Progress Theoret. Phys. (Japan) 6, 801-14(1951) Sept.-Oct.

The anomalous magnetic moment of a nucleon bound in a nucleus differs from the value when it is free because of the modification by the virtual meson cloud around the nucleon due to the effect of other nucleons. This modified value is calculated and shown to be about half of the value when the nucleon is free. With this value of the magnetic moment, the deviations of nuclear magnetic moments from the Schmidt lines can be explained. It is shown that this effect is equivalent to the exchange magnetic moment. (auth)

3067

A STEADY STATE TRANSIENT TECHNIQUE IN NUCLEAR RESONANCE. R. Gabillard. Phys. Rev. 85, 694-5(1952) Feb. 15.

It is pointed out that the nuclear-resonance transient phenomenon described by Bradford, Clay, and Strick (Phys. Rev. 84, 157-8(1951); NSA 5-7244) had been described previously by the author and that its theory had been presented in full (Compt. rend. 232, 324, 1477, 1551(1951)). A discussion is given of new developments in the theory of measurement of the nuclear relaxation time T_2 in liquids in the presence of field inhomogeneities larger than the mean value of the intramolecular field. Three photographs show the following: decay of oscillations for a Gaussian distribution of field inhomogeneities, decay of oscillations for a "square" distribution of field inhomogeneities, and a pre-resonance signal for $T_2 > T_0$. Two special cases are discussed.

3068

A DETERMINATION OF THE NUCLEAR MAGNETIC MOMENT OF Co^{60}, USING THE METHOD OF NUCLEAR ALIGNMENT. B. Bleaney, J. M. Daniels, M. A. Grace, H. Halban, N. Kurti, and F. N. H. Robinson. Phys. Rev. 85, 688-9(1952) Feb. 15.

Further experiments (Nature 168, 780(1951); NSA 6-997) on the alignment of Co^{60} nuclei have been performed. A single crystal with the composition (1% Co, 12% Cu, 87% Zn) $SO_4 \cdot Rb_2SO_4 \cdot 6H_2O$ was cooled by adiabatic demagnetization to $\sim 0.010°K$. The alignment was measured by observation of the anisotropic polar diagram of γ radiation from the crystal. On the assumption that the spin of Co^{60} is 5, a value of 3.0 $\pm$ 0.5 mm was obtained for the magnetic moment. The sign could not be determined from this experiment.

3069

CHARGE DISTRIBUTION IN NUCLEI FROM X-RAY FINE STRUCTURE. A. L. Schawlow and C. H. Townes. Science 115, 284-5(1952) Mar. 14.

Variations in the x-ray fine-structure splitting with Z indicate that charge is either uniformly distributed in the heavier nuclei or slightly denser toward the surface. The discrepancy between the magnitude of isotope shift in optical spectra and that calculated on the basis of uniform charge density may be explained by assuming a dense core of nuclear matter surrounded by a less dense surface. Only the part of added-neutron wave functions inside the core radius is effective in displacing protons outward and so causing isotope shifts.

NUCLEAR REACTORS

3070

Mound Lab.
HOMOGENEOUS REACTOR EXPERIMENT QUARTERLY PROGRESS THROUGH MARCH 17, 1952, by E. Orban. Mar. 31, 1952. 6p. (MLM-680)

A study was made of the physical properties of uranyl sulfate solutions, and any other solutions which may be used in an aqueous homogeneous reactor, to obtain data for engineering calculations. The measurement of density, viscosity, surface tension and vapor pressure of solutions from 0 to 650 grams of uranyl sulfate per liter are being studied.

3071

Carbide and Carbon Chemicals Co. (Y-12)
ADVANCED SEMINAR IN REACTOR PHYSICS, by Nicholas M. Smith, Jr. Mar. 27, 1950. 10p. (Y-F10-14)

NUCLEAR TRANSFORMATION

3072

Atomic Energy Research Establishment, Harwell, Berks (England)
A NEW METHOD FOR CALCULATING THE CRITICAL RADIUS OF SYSTEMS CONTAINING HYDROGEN AND FISSILE MATERIAL, by B. Davison. Jan. 1952. 51p. (AERE T/R-826)

The proposed new method for calculating the critical radius, energy spectrum and the spacial and angular distribution of neutrons in systems containing hydrogen and fissile material is, essentially, as follows. One deals with the angular dependence in the same way as in the spherical harmonics method and then splits each spherical harmonics moment into two parts—the contribution from the neutrons that did not have any hydrogen collisions and the contribution from those which had at least one collision with hydrogen. The energy dependence of the former part is, approximately, the same as in a system not containing hydrogen, while the contribution of neutrons with at least one hydrogen collision is expanded in orthogonal polynomials in velocity and the expansion is terminated after a few terms. (auth)

3073

Ames Lab.
HOT ATOM CHEMISTRY; PHOTONUCLEAR PREPARATION OF COBALT-58, COBALT-58m, by Darleane Christian Hoffman and Don S. Martin, Jr. Apr. 17, 1952. 19p. (ISC-212)

Samples of $K_3[Co(C_2O_4)_3].3H_2O$ were irradiated in the x-ray beam of the 68-Mev synchrotron. The Szilard-Chalmers process appeared to be nearly 100 per cent effective in ejecting the radioactive cobalt atoms from the complex. The 9.2-hr Co^{58m} and 72-d Co^{58} formed during the irradiation were separated from the complex in high specific activity by adsorption on IRC-50 cation exchange resin. The total saturation yield for Co^{58} and Co^{58m} was found to be 8.6 relative to C^{11}. A solution of the complex was prepared from the active cobalt separated by adsorption on the resin. A method utilizing the chemical decomposition of the complex, occurring in the isomeric transition of Co^{58m} to Co^{58} by the emission of conversion electrons, was employed to calculate the ratio of the rates of formation of the two isomers. The ratio of the photonuclear rate of formation of Co^{58} to that of Co^{58m} was found to be 0.61 ± 0.04. (auth)

3074

Rochester Univ.
THE PARITIES OF THE GROUND STATES OF N^{14} AND C^{14}, by D. A. Bromley and L. M. Goldman. Apr. 10, 1952. 5p. (NYO-3209)

Experiments based on the stripping theory of S. T. Butler (Proc. Roy. Soc. (London) A208, 559(1951)) were used to determine the relative parities of N^{14} and C^{14}. Using 4-Mev deuterons from the Rochester 26-in. cyclotron, the angular distribution of neutrons from the $C^{13}(d,n)N^{14}$ reaction and the distribution of the protons from the $C^{13}(d,p)C^{14}$ reaction were examined. The angular distributions of the protons and neutrons are almost identical. Data show conclusively that the parities of the N^{14} and C^{14} ground states are the same. Therefore it is no longer possible to invoke a parity change in the explanation of the C^{14}, N^{15} β decay. The relative parities of the C^{12} and C^{13} ground state using the $C^{12}(d,p)C^{13}$ reaction have been confirmed, consequently showing that the parities of the ground state of N^{14} and C^{14} are the same as that of the C^{12} ground state which is assumed to be even.

3075

Johns Hopkins Univ.
ANGULAR DISTRIBUTION MEASUREMENTS OF NUCLEAR REACTIONS, by S. S. Hanna. Oct. 1, 1950. 54p. (NYO-553)

A brief survey of the theoretical implications of angular distribution measurements is given. Two experimental methods for measuring angular distribution are described. One involves the use of a deep proportional counter and a ten-channel discriminator for analyzing the counter pulses; the other uses photographic plates in the target vacuum with limited magnetic deflection of the product particles. Both methods were designed particularly for resolving energy groups of particles so that the low-lying excited states of residual nuclei could be studied. The two proton groups in the $Li^6(d,p)$ reaction were investigated by the counter method; the results obtained with deuterons of energy 400, 430, 540, 650, and 780 kev are presented in tables and graphs. The photographic method was used to investigate the reactions produced by proton and deuteron bombardment of Be; the results are discussed at some length. In general the angular distribution of all these reactions are fairly complex in the energy range studied below 1 Mev. A bibliography of angular distribution measurements and analyses is appended.

3076

Radiation Lab., Univ. of Calif.
FAST MESON INTERACTIONS IN NUCLEAR EMULSIONS. PART I: ON π-MESONS, by Hugh Bradner and Bayard Rankin. Feb. 25, 1952. 26p. (UCRL-1691)

π^- mesons produced in the Berkeley cyclotron are collimated and monochromatized to 35 ± 2 Mev by a toothed channel in the magnetic field of the cyclotron. Tracks of these mesons obtained in Ilford G5 emulsions are followed and studied for scatter, nuclear stars and disappearances in flight. The energy distribution of the accepted mesons is critically examined and a low-energy cut-off for the initial energy is established. 65 percent of the meson track is above 30 Mev in the region of observation, while the remaining 35 percent may drop to 20 Mev. The selection of the high energy particles and their identification by small-angle scatter and grain density is discussed. Proton contamination is eliminated largely by small-angle scatter. Electrons are ruled out by grain count. In 902 cm of track

there are 5 disappearances and 26 scatters greater than 30°; 4 of the scatters are detectably inelastic, with energy transfer greater than 18 Mev. The combined cross section for stars, disappearances, and inelastic scatters is equal to the cross section for elastic scatters. The measured value for total nuclear interaction is statistically compatible with the combined nuclear area for the responsible elements, oxygen, carbon, bromine, and silver. (auth)

3077

Radiation Lab., Univ. of Calif.

MOMENTUM TRANSFER IN NUCLEAR EXCITATION BY HIGH ENERGY PARTICLES, by Si-Chang Fung and I. Perlman. Mar. 11, 1952. 20p. (UCRL-1709)

When accelerated protons, deuterons, and alpha particles of the order of 100-Mev energy strike thin aluminum foils (0.25 to 0.5 mil), sizable percentages of the Na^{24} formed are ejected by the recoil process. In the higher energy range the percentage of Na^{24} ejected from the foil decreases with increase in energy of the incident particle. This behavior is first shown semiquantitatively to be a consequence of constant nuclear excitation in contrast to compound-nucleus formation. Calculations are made for the expected loss of Na^{24} assuming compound-nucleus formation along with randomly distributed ejection of particles in the production of Na^{24}, and the agreement is found satisfactory for 70-Mev protons and 80-Mev alpha particles but not for higher energies. Calculations are also made for the case of constant nuclear excitation with the incident particle of degraded energy leaving in the forward direction, and satisfactory agreement with the experimental values are found here over the entire energy range studied. (auth)

3078

RELATIVE PROBABILITIES OF DIVERSE PHOTONUCLEAR REACTIONS FROM Zn^{64} AND Fe^{54}. Ryokichi Sagane. Phys. Rev. 85, 926-7(1952) Mar. 1.

Measurements with a synchrotron x-ray beam of 67-Mev maximum energy of the relative cross sections of (γ,n), (γ,pn) and $(\gamma,2np)$ reactions on Zn^{64} and Fe^{54} are plotted, and relative integrated cross sections are tabulated.

3079

PROTON BOMBARDMENT OF LITHIUM. J. K. Bair, H. B. Willard, C. W. Snyder, T. M. Hahn, J. D. Kington, and F. P. Green. Phys. Rev. 85, 946(1952) Mar. 1.

Lithium of normal isotopic ratio was bombarded with monoenergetic protons of energies between 1.8 and 5.3 Mev. The yield of neutrons in the forward direction was measured with a conventional "long" counter at a distance of 1 m from the rotating target. Gamma-rays of energy greater than 10 Mev were detected with a large NaI crystal as a scintillation detector. A new neutron peak at 4.89-Mev proton energy, corresponding to an excited state in Be^8 in the vicinity of 21.5 Mev, was observed. Full width at half-maximum of the resonance at 4.89 Mev was approximately 0.4 Mev. The γ-ray yield was essentially constant. A level with 3% of the intensity of the 440-kev resonance would have been easily observed.

3080

THE REACTION $Li^6(t,p)Li^8$. C. D. Moak, W. M. Good, and W. E. Kunz. Phys. Rev. 85, 928(1952) Mar. 1.

By bombarding $Li_2^6SO_4$ with 350-kev tritons and detecting the 0.89-sec Li^8 β particles, the authors have proved that the Be^{9*} intermediate decays by proton emission to Li^8, in addition to other known decay mechanisms.

3081

HIGH ENERGY PHOTODISINTEGRATION OF THE DEUTERON. T. S. Benedict and W. M. Woodward. Phys. Rev. 85, 924-5(1952) Mar. 1.

The differential cross section has been measured for protons arising from the photodisintegration of the deuteron at laboratory angles of 60, 90, and 120° for γ-ray energies from 80 to 160 Mev. The electric-quadrupole cross section is estimated to be 1% of the electric-dipole cross section in this energy region, and the isotropic contribution is estimated to be 40% of the electric-dipole cross section.

3082

ON THE HIGH ENERGY NUCLEAR PHOTOELECTRIC REACTION. S. Yoshida. Progress Theoret. Phys. (Japan) 6, 1032-4(1951) Nov.-Dec.

The angular distribution is calculated for high-energy protons produced during high-energy photon irradiation of nuclei. Good agreement between experimental data and the calculated results is obtained. Graphs of the results and those of Levinger (Phys. Rev. 84, 43(1951)) show that at the lower energies the one-particle model is a good approximation, while at higher energies the α-particle model and the deuteron model become better approximations.

3083

CAPTURE GAMMA-RAYS FROM 277-KEV PROTONS ON N^{14}. C. H. Johnson, G. P. Robinson, and C. D. Moak. Phys. Rev. 85, 931-2(1952) Mar. 1.

A pulse-height spectrum for γ rays produced by the resonant capture of 277-kev protons by N^{14} is shown to result from six γ rays of energies 0.75 ± 0.03, 1.39 ± 0.03, 2.38 ± 0.10, 5.29 ± 0.010, 6.21 ± 0.10, and 6.84 ± 0.10 Mev. These are attributed to three cascade processes of two γ rays each from the 7.60-Mev level of O^{15} to the ground state, indicating three intermediate levels in O^{15}.

3084

NEUTRONS AND GAMMA-RAYS FROM THE PROTON BOMBARDMENT OF BERYLLIUM. T. M. Hahn, C. W. Synder, H. B. Willard, J. K. Bair, E. D. Klema, J. D. Kington, and F. P. Green. Phys. Rev. 85, 934(1952) Mar. 1.

The neutron and γ-ray yields in the forward direction resulting from the proton bombardment of Be have been extended to a maximum proton energy of 5.3 Mev. A new level at 4.72 ± 0.01 Mev with a full width at half-maximum of ~0.5 Mev was observed in addition to the known 2.57 ± 0.01-Mev level.

3085

POLARIZATION OF THE 6.13-MEV GAMMA-RAYS EMITTED IN THE REACTION $F^{19}(p,\alpha)O^{16*}(\gamma)O^{16}$. A. P. French and J. O. Newton. Phys. Rev. 85, 1041(1952) Mar. 15.

The polarization of the γ rays from the 6.13-Mev level of O^{16} was measured with terphenyl-xylene scintillation counters at an angle of 118° to the corresponding α particles from the $F^{19}(p,\alpha)$ reaction. The resulting ratio of scattered intensities in the polarization planes was 1.14 ± 0.06, in agreement with a spin of 3, electric octupole decay, and odd parity for O^{16*}. It follows that the ground state of F^{19} and the excited state in Ne^{20} have even parity. The absence of long-range α-particle emission from this Ne^{20} level to the ground state of O^{16} is accounted for, since conservation of both angular momentum and parity in such a transition becomes impossible.

PARTICLE ACCELERATORS

3086

Radiation Lab., Univ. of Calif.

D-C DRAIN AND BREAKDOWN PHENOMENA FOR UNOUTGASSED METALS, by H.G. Heard. Mar. 1952. 31p. (UCRL-1697)

A study of electrode drain and breakdown phenomena is reported for d-c voltages up to 100,000 volts. The effect of pumping fluids and trapping agents on the total drain between electrolytic copper electrodes is discussed. Radioactive tracer experiments using Cu^{64} show that anode metal is transferred to the cathode in a non-sparking discharge. Simultaneous observations of total cavity pressure and electrode drain as a function of electrode voltage serve to clarify the breakdown phenomena.

3087

Nuclear Physics Lab., Washington Univ.

THE UNIVERSITY OF WASHINGTON 60 INCH CYCLOTRON; PROGRESS AND STATUS REPORT OF DESIGN AND CONSTRUCTION. June 1951. 100p. (AECU-1951)

The design and construction of the 60-in. cyclotron at the Univ. of Washington are discussed. The cyclotron is reported to be assembled and ready for initial testing. Numerous photographs illustrate the steps in construction.

3088

THE DESIGN OF GLASS VACUUM CHAMBERS OF ELLIPTIC CROSS SECTION. S. J. Morrison. Engineer 193, 426-8(1952) Mar. 28.

When the material of construction of toroidal vacuum chambers used in betatrons and synchrotrons is glass, the determination of a suitable wall thickness is important. An "engineering" approximation is made by considering the stress in a long, straight cylinder of elliptic section. Calculated and experimental results are compared.

RADIATION ABSORPTION AND SCATTERING

3089

Radiation Lab., Univ. of Calif.

PROTON-PROTON COLLISIONS WITHIN LITHIUM NUCLEI, by Owen Chamberlain and Emilio Segrè. Mar. 20, 1952. 10p. (UCRL-1735)

Proton-proton collisions within the Li nucleus have been investigated by means of a coincidence arrangement between two counters A and B in a horizontal plane containing the proton beam. Counter A was at angle ϕ from the beam and B at angle θ from the beam on the opposite side. Detector A was held at fixed angles ($\phi = 30°$ and $\phi = 45°$) while the coincidence rate was measured as a function of θ; the data obtained are presented in the form of graphs. Similar curves were obtained by moving counter B vertically, out of the plane defined by the beam and counter A. These have been used to perform an integration of the coincidence counting rate over all positions of counter B, to obtain the differential cross section for this effect in the direction of counter A. The result is $39 \pm 4 \times 10^{-27}$ cm^2/sterad at 30° (lab.) obtained with Li. A simple mathematical analysis is presented by assuming p-p scattering by an individual proton in the Li nucleus, both protons escaping without further collision; conservation of momentum and energy is applied to the system.

3090

Radiation Lab., Univ. of Calif.

THE SCATTERING OF PROTONS FROM CARBON, by Peter A. Wolff. Mar. 12, 1952. 21p. (UCRL-1410(Rev.))

Using the impulse approximation, a formula has been derived which gives the energy spectra of protons scattered from carbon in terms of the nuclear momentum distribution. Estimates of the errors involved in this formula give values of 5 to 10% for a 340-Mev bombarding energy. A comparison is made with the experimental data of Cladis and it is concluded that a gaussian momentum distribution gives a good fit to his results. (auth)

3091

STOPPING POWER OF HEAVIER SUBSTANCES. J. Lindhard and M. Scharff. Phys. Rev. 85, 1058-9(1952) Mar. 15.

A simple way of comparing experimental data on the stopping of fast particles of low charge is described. The data may be described by a single function of Z/v^2 common to all elements of not too low atomic number.

3092

THE ELASTIC SCATTERING OF DEUTERONS BY DEUTERONS. Richard J. Runge. Phys. Rev. 85, 1052-3 (1952) Mar. 15.

An analytical solution of the problem of the elastic scattering of deuterons by deuterons is obtained for the case of an interaction between nucleons of the type $V_{ij} = -(g_i + MP_{ij} + g_2Q_{ij} + gP_{ij}Q_{ij}) W_0 \exp(-\mu^2 r_{ij}^2)$, where $M = 1-g-g_1-g_2$ (Motz and Schwinger, Phys. Rev. 58, 26(1940)). A Coulomb repulsion between the two protons of the system is included. The deuteron ground state is assumed to be a ^3S state described by the Gaussian wave function, $\psi_0(r) = a \exp(-\lambda^2 r^2)$, where $a^2 = 2^{3/2}\lambda^3/\pi^{3/2}$, that is, the ^3D state is not included in the calculation. In addition polarization of the deuterons is neglected. The results are compared with available experimental data.

3093

MULTIPLE GAMMA-RAY SCATTERING IN LEAD. J. O. Elliot, R. T. Farrar, R. D. Myers, and C. F. Ravilious. Phys. Rev. 85, 1048-9(1952) Mar. 15.

The distribution function in Pb for scattered photons from a Co^{60} point isotropic source was calculated by the method of Spencer and Fano (J. Research Natl. Bur. Standards 46, 446(1951)) in order to check the consistency of the theoretical predictions with experimental build-up factors measured in Pb. These factors were measured in Pb bricks containing 2.89% Sb for a 2.74-c Co^{60} source in the form of a cylindrical pellet 1 cm in diameter and 1 cm in length.

3094

VARIATIONAL CALCULATION OF SCATTERING CROSS SECTIONS. E. Gerjuoy and David S. Saxon. Phys. Rev. 85, 939-40(1952) Mar. 1.

Preliminary results are reported on calculations attempting to assess the utility of Schwinger's variational formulation of the scattering problem when ka is so large that a phase-shift analysis, i.e., an expansion in a series of spherical harmonics, is a slowly converging procedure. Significant improvement over the Born approximation and the usual variational calculation is obtained by using a linear combination of forward- and backward-traveling plane waves as a trial function inside the potential well.

3095

THE SCATTERING OF 9.6-MEV PROTONS BY CARBON, ALUMINUM, AND MAGNESIUM. C. J. Baker, J. N. Dodd, and D. H. Simmons. Phys. Rev. 85, 1051-2(1952) Mar. 15.

Experimentally determined range-distribution and angular-distribution curves for 9.6-Mev protons scattered by Mg of normal isotopic composition are presented and discussed. Scattering by carbon foils was used to determine the accuracy of these measurements. The following energy levels in Al^{27} were observed: 0.00 ± 0.05, 1.72 ± 0.15, 2.22 ± 0.08, 3.00 ± 0.05, 3.63 ± 0.12, 3.93 ± 0.10, 4.39 ± 0.12, 4.66 ± 0.10, and 5.46 ± 0.08.

3096

THE M$_5$ AND M$_4$ X-RAY ABSORPTION EDGES OF TANTALUM. Donald D. Doughty and J. W. McGrath. Phys. Rev. 85, 1040(1952) Mar. 15.

The following values for Ta were determined with a Siegbahn-type vacuum spectrograph. The discrepancies may be the result of the M$_5$ and M$_4$ electrons going to the lattice level originating from the P$_{2,3}$ level in the free Ta atom.

Edge	Wavelength (X.U.)	ν/R	Observed energy (ev)	Energy computed from L lines (ev)	Discrepancy (ev)
M$_5$	7033 ± 5	129.3 ± 0.1	1760 ± 2	1730	+30
M$_4$	6845 ± 5	132.8 ± 0.1	1808 ± 2	1788	+20

3097

VARIABLES IN THE SELF-ABSORPTION OF LOW-ENERGY BETA PARTICLES. George K. Schweitzer and James W. Nehls. J. Phys. Chem. 56, 541-4(1952) Apr.

The effects of a number of factors in the self-absorption of the low-energy β particles of S^{35} and Ca^{45} have been investigated. Variations in the atomic number of the sample material, the atomic number of the backing, the sample-to-counting tube window distance, and the counting tube window thickness all have an appreciable effect upon the shape of the per cent specific activity vs. surface density curve. The atomic number of the siding material surrounding the sample does not appear to influence the shape of the per cent specific activity plot. Some data have been accumulated on samples containing both S^{35} and Ca^{45}. The results are in accord with what one would expect from the energies of the β particles being emitted by the two nuclides. (auth)

3098

THE STOPPING POWER OF A METAL FOR CHARGED PARTICLES. David Pines. Phys. Rev. 85, 931(1952) Mar. 1.

The collective description of electron interactions has been applied to the determination of the contribution of the conduction electrons in a metal to its stopping power for a fast nonrelativistic charged particle. The conduction electrons are treated as a gas of point electrons embedded in a medium of uniform positive charge, and only the electron-electron interactions are considered. Expressions are given for loss of energy by fast charged particles to the conduction electrons by (1) long-range coulomb interaction resulting in excitation of collective oscillations in the form of a wake, closely resembling Cherenkov radiation, and (2) short-range collisions.

3099

INVARIANCE CONDITIONS ON THE SCATTERING AMPLITUDES FOR SPIN ½ PARTICLES. L. Wolfenstein and J. Ashkin. Phys. Rev. 85, 947-9(1952) Mar. 15.

The most general form of the scattering matrix in spin space for two spin-½ particles is derived subject to invariance under rotation, reflection, and time-reversal. The result may be used to prove a relationship important for polarization experiments and previously stated without proof. (auth)

3100

RADIATIVE CORRECTION FOR THE COLLISION LOSS OF FAST PARTICLES. J. M. Jauch. Phys. Rev. 85, 950-2 (1952) Mar. 15.

The correction for the collision loss of fast heavy particles because of the interaction with the radiation field is calculated approximately. The radiative corrections always result in a decrease of the collision loss. Only the collisions with energy loss $\epsilon > \frac{1}{2}mc^2$ contribute significantly to this result. For $\gamma = 1000$ and $Z = 18$ (argon) the correction amounts to about 6%. (auth)

3101

SYMMETRY EFFECTS ON NUCLEAR DIPOLE RADIATION WITH APPLICATION TO A BOUND EXCITED STATE OF $_2He^4$. Lynne E. H. Trainor. Phys. Rev. 85, 962-72(1952) Mar. 15.

The effect of nuclear symmetry properties on electric dipole transitions is investigated using the independent particle model and Wigner's theory of the symmetric hamiltonian. Methods are given for the construction of completely symmetrized wave functions for the nuclear states on this model. Symmetry selection rules are found to operate, in addition to the usual selection rules, to reduce the amount of nuclear dipole radiation. A detailed study of the He^4 nucleus leads to the conclusion that if a resonant state at 21.6 Mev does exist with a strong dipole transition to the ground state, then a bound, excited state of the α-particle also exists. Spin-orbit and tensor forces are introduced to give a possible explanation of the angular distribution of γ-rays when protons are captured by tritium. (auth)

3102

NOMOGRAPHIC REPRESENTATION OF COLLISIONS BETWEEN TWO PARTICLES WITH ATOMIC DIMENSIONS. F. Mariani. Nuovo cimento (9) 8, 297-300(1951) May 1. (In Italian)

A nomogram is presented which enables the momenta, energies, and angles of scattering of two particles following relativistic collision to be determined for the laboratory frame of reference with an error $\leq 2\%$.

3103

ON THE VARIATION IN ABSORPTION OF A NEUTRON BEAM AS A FUNCTION OF THE GEOMETRIC CONDITIONS. G. Stiennon. Bull. soc. roy. sci. Liège 20, 667-74 (1951) Nov. (In French)

Since each point of an absorber interposed between a point source and a counter of finite area can be considered in turn as a point source, the counter efficiency will vary with area, thickness, and position of the absorber. The effect of these variables has been studied for concrete and paraffin absorbers located between a 250-mc Ra-Be neutron source and a BF_3 counter. The experimental results are compared with calculated values.

RADIATION EFFECTS

3104

Westinghouse Atomic Power Div.

DISPLACED ATOM DENSITIES IN CYCLOTRON IRRADIATED METALS, by F. C. Brooks. Jan. 4, 1952. Decl. Mar. 25, 1952. 11p. (AECD-3341; WAPD-RM-104)

The number of displaced atoms in equilibrium in a thin cyclotron-bombarded target is estimated as a function of the bombarding particle energy and target temperature. The equilibrium displaced atom density, n_∞, is found to be extremely sensitive to temperature. A particular case, 10-Mev deuterons striking a copper target, is considered in detail. If the bombarding flux is one microampere/cm^2 and the temperature 300°K, n_∞ becomes 3.1×10^{18}/cm^3 and about one atom in four thousand is displaced at equilibrium. However, if the temperature is lowered to 200°K, one atom in every twenty is displaced at equilibrium. (auth)

RADIOACTIVITY

3105

Rochester Univ.

SHELL MODEL PREDICTIONS IN BETA-DECAY, by Albert G. Petschek. Nov. 10, 1951. 24p. (NYO-3035)

Using the ft values of the β transitions and the shell model of M. G. Mayer, a table of spin and parity assignments for nuclear orbital β transitions was compiled. A separate tabulation is made for odd and for even nuclei. The nuclei considered were chosen from recently published articles on the basis of large comparative half lives and reliable isotopic identification. The list is similar to one published by Mayer, Moszkowski, and Nordheim (ANL-4626 and Revs. Modern Phys. 23, 315-22(1951)).

3106

Johns Hopkins Univ.

STUDIES OF NUCLEAR GAMMA RAYS; ANNUAL REPORT, by L. Madansky and F. Rasetti. Sept. 1, 1951. 31p. (NYO-674)

The experimental procedure used to study both $\alpha-\gamma$ and $\gamma-\gamma$ correlations is described. Block diagrams of the experimental setup for the correlation studies are given. A probable disintegration scheme for RdTh(Th^{228}) was developed from the $\alpha-\gamma$ correlated data. $\gamma-\gamma$ correlation studies are reported for Co^{60}, Cs^{134} and La^{140}. The decay scheme for Cs^{134} and La^{140} are given. The general problem of internal bremsstrahlung is discussed in the light of some new theoretical results obtained at this laboratory.

Experimental measurement have been obtained for P^{32} and Bi^{210}. Meson capture, design of a liquid scintillation counter, and design of a mixing circuit are also discussed.

3107

Brookhaven National Lab.

PAIR MEASUREMENT OF GAMMA-RAYS WITH A LENS SPECTROMETER, by David E. Alburger. Mar. 6, 1952. 27p. (BNL-1140)

A conventional lens spectrometer has been adapted to the measurement of high energy gamma rays by detecting positron-electron pairs in coincidence. The source and converter are centered on the optic axis and the baffle system selects pairs of nearly equal energy. The detection method consists of dividing the focal circle of confusion in half and observing coincidences between particles entering these two regions. Statistically the components strike different areas in half the cases. The detectors are semi-circular anthracene crystals connected by light pipes to 1P21 photomultiplier tubes. Pulses from these are fed through amplifiers to a coincidence circuit of 7×10^{-8}-sec resolving time. The method has been tested by observing "pair peaks" due to the 2.76- and 2.62-Mev gamma rays of Na^{24} and $ThC''(Tl^{208})$ respectively. The Po-Be reaction gamma ray has been measured at 7.5-percent resolution and found to have an energy of 4.47 ± 0.04 Mev. Using a proton beam from the Brookhaven electrostatic accelerator gamma rays of 6.19 ± 0.08 Mev and 7.13 ± 0.12 Mev occurring in the $F^{19}(p,\alpha)O^{16}$ reaction have been observed with this apparatus. The results on both Po-Be and the fluorine reaction are in agreement with previous measurements by other methods. (auth)

3108

Radiation Lab., Univ. of Calif.

THE ALPHA PARTICLES OF RADIUM, by F. Asaro and I. Perlman. Mar. 13, 1952. 7p. (UCRL-1725)

Measurements were made on the abundance and energy of the α groups emitted from Ra^{226}. Graphs are presented showing the two known peaks separated by 188 kev. The α group of 600 kev below the main group as reported by Rosenblum et al. (Compt. rend. 229, 191(1949); 195, 317 (1932)) was not found. The relative abundance of each group is also given.

3109

Ames Lab.

SECONDARY ELECTRON SPECTRUM OF Pr^{142}, by Erling N. Jensen, L. Jackson Laslett, and D. J. Zaffarano. Apr. 15, 1952. 7p. (ISC-218)

The secondary electron spectrum of Pr^{142} was examined to make a search for low energy γ rays and to determine the existence or non-existence of an appreciable number of secondary electrons produced by bremsstrahlung. A sample of spectrographically pure Pr_6O_{11} was irradiated in the Argonne reactor and then examined with a thin-lens spectrometer modified to incorporate ring focusing. Only one γ ray was observed, having an energy of 1.576 Mev. Since no low-energy γ rays were observed and the material surrounding the source was sufficient to absorb completely electrons with an energy greater than 5 Mev, it was concluded that the broad distribution of electrons observed at the low-energy end of the spectrum, in addition to the expected compton distribution, is due to secondary electrons that are produced in the Cu cap and U foil by the bremsstrahlung arising in the Cu cap due to the absorption of the β particles. The secondary electron spectrum of Pr^{142} is regarded as a composite of the photoelectrons and compton electrons arising from a single γ ray, plus the electrons produced by bremsstrahlung.

3110

A STUDY OF RADIOACTIVITIES IN THE BARIUM AND STRONTIUM REGIONS. Bennett Eugene Robertson. Ph.D. Thesis, Ohio State Univ., 1950.

Enriched Ba and Sr samples, together with natural Ba and Sr salts, were subjected to nuclear bombardments using the 5-Mev protons, 10-Mev deuterons, and 20-Mev α particles from the Ohio State Univ. cyclotron. The radioactivities including the decay schemes of Ba and Sr isotopes and the isotopes resulting from the nuclear reactions, i.e., La, Cs, Y, and Zr are given.

3111

INVESTIGATION ON (1) BOMBARDMENTS WITH TRITONS AND (2) RELATIVE CROSS SECTION MEASUREMENTS. Dhirendra Nath Kundu. Ph.D. Thesis, Ohio State Univ., 1950.

The 13-hr Pd^{109} activity produced by the reaction $Ag^{109}(t,He^3)Pd^{109}$ is discussed. The reactions $Rh^{103}(t,p)Rh^{105}$ and $Co^{59}(t,p)Co^{61}$ were studied in an attempt to confirm the existence of the dineutron. The variation of the per cent of the isotopic components in the bombardment targets enabled the setting up of a system of equations, each corresponding to a different activity, with the cross sections as unknowns. By properly monitoring the bombarding beam these equations could be solved simultaneously to give the relative cross sections, provided that the details of the decay scheme of the resulting radioactive nuclei were known. The relative cross sections for the reactions (p,n) to (p,γ) and (d,n) to (d,2n) leading to the 20-hr Tc^{95} and the 4.3-day Tc^{96} activities are measured by this method by using natural Mo and enriched $Mo^{94}O_3$.

3112

SOME CONTRIBUTIONS TO THE THEORY OF RADIOACTIVITY. Mu-Hsien Wang. Ph.D. Thesis, Univ. of Cambridge, 1950.

The dissertation consists of four sections. First, the process of "internal pair conversion" is investigated, in which γ rays emitted from the nucleus of a radioactive atom are absorbed by the atomic system, giving rise to a pair consisting of a positive and a negative electron. The coefficient of such a conversion of the γ rays is calculated on the assumption that the γ ray is magnetic dipole radiation. Secondly, a general formulation of the theory of orbital electron capture and β decay is worked out by using as the interaction responsible for the decay process a linear combination of the five possible invariant interactions, namely, the scalar, vector, tensor, pseudo-vector, and pseudo-scalar interactions with arbitrary coefficients and on the assumption that the mass of the neutrino is finite. Formulas for special cases are deduced. Numerical results for different electron captures are given in order to serve as information for the experimental workers in this field. Thirdly, Fermi's theory is applied to the β decay of the cosmic-ray mesons for a possible process, namely the disintegration of a charged meson into two identical neutral particles and an electron. Some numerical results are given. Finally, the momentum dependence of the directional correlation between the successive β and γ emissions from a nucleus is discussed. Examples of the allowed and of the first-order forbidden β decay and dipole γ-radiation are worked out in some detail.

3113

RADIOACTIVITY OF OCEAN SEDIMENTS. VIII. RADIUM AND URANIUM CONTENT OF OCEAN AND RIVER WATERS. Elizabeth Rona and William D. Urry. Am. J. Sci. 250, 241-62(1952) Apr.

Variations of the Ra content of ocean waters, both later-
ally and in depth, appear to be attributable to the presence
of different water masses. Open ocean waters contain only
about 16% of the amount of radium that would be in radioac-
tive equilibrium with the U content, a finding in agreement
with the work of previous investigators on inshore waters.
This departure from equilibrium is quantitatively the com-
plement of the departure from equilibrium in presently de-
posited ocean sediments. Ocean waters lack also the ionium
content required for equilibrium with the U content. A few
measurements of the Ra and U contents of river waters show
that the departures from radioactive equilibrium are in the
opposite direction from similar departures in ocean waters,
and in this respect the relations between the radioelements
in river waters are qualitatively the same as those in the
ocean sediments. (auth)

3114

COINCIDENCE MEASUREMENTS IN Zn^{65} AND BETA RAY
SPECTRA OF Sr^{90} AND Y^{90}. Ruth Adlyn Cohn. Ph.D.
Thesis, Ohio State Univ., 1950.

The study of Zn^{65} was undertaken to substantiate the
scheme of disintegration and to obtain more exact informa-
tion concerning the difference in energy levels between the
ground states of Zn^{65} and Cu^{65}. The present investigation of
the spectra of Sr^{90} and Y^{90} was made with a Wilson cloud
chamber. The research yielded a value of 2.03^2 mc or 0.525
Mev for the maximum energy of the Sr^{90} β spectrum and 5.4
mc^2 or 2.24 Mev for the maximum energy of the Y^{90} β spec-
trum.

3115

RADIATIONS OF Rh^{99}, Rh^{101}, Rh^{105}, AND Ru^{105}. C. L.
Scoville, S. C. Fultz, and M. L. Pool. Phys. Rev. 85,
1046(1952) Mar. 15.

Bombardment of Ru metal with 6.3-Mev protons gave an
allowed, probably simple, positron spectrum for 4.5-hr
Rh^{99} with an end-point energy of 0.74 ± 0.01 Mev for which
the log (ft) value was 4.95. No γ rays of 4.5-hr half life
were observed. The intensity of the Rh^{100} positrons was
not sufficiently high to give a reliable Kurie plot. K and L
conversion electrons of 0.148 ± 0.005- and 0.300 ± 0.005-
Mev γ rays of 4.5-day Rh^{101} were observed. Bombardment
with 10-Mev deuterons gave simple, allowed negatron
spectra for 4.5-hr Ru^{105} and 36-hr Rh^{105} with end-point
energies of 1.15 ± 0.02 and 0.57 ± 0.01 Mev, respectively.
Conversion lines of a 0.127 ± 0.005-Mev γ ray were attri-
buted to Rh^{105}.

3116

A SECOND γ-TRANSITION ($d_{3/2} \rightarrow s_{1/2}$) in Xe^{129m}. S. Thulin
and I. Bergström. Phys. Rev. 85, 1055(1952) Mar. 15.

A γ ray of 40.0-kev energy has been found in Xe^{129m}. The
The 8.0-day Xe^{129m}, which has a $h_{11/2}$ spin, thus decays by
196-kev γ emission to the 40-kev $d_{3/2}$ level, to which also
decays I^{129}, followed by 40.0-kev γ emission to the $s_{1/2}$
stable state. The crossover transition was not observed.
The results for Xe^{129m} are in excellent agreement with
strong spin-orbit coupling.

3117

THE HALF-LIFE OF THE 1.3-MEV EXCITED STATE IN
K^{41}. L. G. Elliott. Phys. Rev. 85, 942(1952) Mar. 1.

Delayed-coincidence measurements with trans-stilbene
scintillation counters of the β decay of A^{41} (99.3% to the 1.3-
Mev excited state of K^{41} and 0.7% to the ground state) gave
a value of $6.7 \pm 0.5 \times 10^{-9}$ sec for the half life of the excited
state. This value is appreciably in excess of the 0.45×10^{-9}-
sec theoretical half life given by Weisskopf's formula on
the assumption that the excited state is a $f_{7/2}$ level.

3118

INTERNAL CONVERSION IN THE L-SHELL. H. Gellman,
R. A. Griffity, and J. P. Stanley. Phys. Rev. 85, 944(1952)
Mar. 1.

Calculated values of internal-conversion coefficients for
electric-dipole, electric-quadrupole, and magnetic-dipole
radiations for the L, L_I, L_{II}, and L_{III} shells of Z = 49, 84,
and 92 are tabulated.

3119

MAGNETIC SPECTROMETER STUDIES OF RADIOACTIVE
ISOTOPES. Leslie Robert Shepherd. Ph.D. Thesis, Univ.
of Cambridge, 1950.

A thin-magnetic-lens β spectrometer and auxiliary equip-
ment similar to the design of Deutsch (Rev. Sci. Instruments
15,(1944)) is described. The electron optics of the instru-
ment and the techniques involved in measuring the β and γ
radiation spectra are discussed. The β spectrum of Ba^{139},
Ce^{141}, Sm^{153}, Eu^{152}, and Y^{90} are given. The soft γ rays emitted
in some of the disintegrations are also discussed. The re-
sults are considered in conjunction with data obtained by J.
M. Hill using coincidence and absorption techniques.

3120

RADIOACTIVITY OF $Eu^{152,154}$. Robert Katz and Milford R.
Lee. Phys. Rev. 85, 1038-9(1952) Mar. 15.

Conversion lines of 121.2-, 122.4-, 243.8-, and 343.8-
Mev γ rays were found in neutron-activated enriched Sm^{150}
and Sm^{154} containing $\leq 0.6\%$ Eu. On the assumption that the
Eu isotopes were enriched in the same way as the Sm, the
121.2-, 243.8-, and 343.8-Mev γ rays are attributed to Eu^{152},
and the 122.4-Mev line to Eu^{154}. Long-lived γ activity
assigned to Sm^{145} or Sm^{155} in the literature is clearly the
result of Eu contamination.

3121

ON THE MESONIC CORRECTION TO THE β-DECAY.
Tsuneyuki Kotani, Shigeru Machida, Seitaro Nakamura,
Hisao Takebe, Minoru Umezawa, and Tets Yoshimura.
Progress Theoret. Phys. (Japan) 6, 1007-12(1951) Nov.-Dec.

General types of the mesonic correction to β-decay are
obtained from the invariance requirements. Explicit cal-
culations are performed, using the Feynman-Dyson method,
up to the second order of meson-nucleon compling con-
stants for the symmetrical pseudoscalar meson theory with
both pseudoscalar and pseudovector couplings. It is shown
that the mesonic correction is small and does not affect
the selection rules and spectra in Konopinski's forbidden
theory. (auth)

3122

NEUTRON CAPTURE γ-RAYS FROM PHOSPHORUS, SUL-
FUR, CHLORINE, POTASSIUM, AND CALCIUM. B. B.
Kinsey, G. A. Bartholomew, and W. H. Walker. Phys. Rev.
85, 1012-23(1952) Mar. 15.

The prominent capture γ rays from P, S, Cl, K, and Ca
have been studied with the aid of a pair spectrometer. The
neutron binding energies obtained for P^{32}, S^{33}, Cl^{36}, and K^{40}
are 7.94 ± 0.03, 8.64 ± 0.02, 8.56 ± 0.03, and 7.77 ± 0.03
Mev. Neutron capture in P produces a complicated spectrum
in which the ground-state γ ray is weak. Most of the cap-
tures in S occur in S^{32} and produce S^{33} in a cascade process
involving the fifth excited state near 3.2 Mev. The direct
transition to the ground state in S^{33} is weak. In Cl the ground
state γ ray and those produced by transitions from the cap-
turing state to the first six excited states in Cl^{36} are of
comparable intensity. In K there are relatively strong tran-
sitions to the ground state and to the second excited state of
K^{40}. Some of the γ rays produced by K can be identified with
transitions in K^{42}, the excited state at 2.3 Mev being favored

above all others. Three very weak γ rays have been de-
tected with energies above that to be expected from capture
in K^{39} and K^{41}. These γ rays do not appear to be due to im-
purities. It is possible that they arise from the capture
of neutrons by K^{40} and, if this hypothesis is correct, that iso-
tope must have a large capture cross section for thermal
neutrons. In Ca the greater part of the γ-ray spectrum can
be fitted into the energy-level system of Ca^{41}. No γ ray
corresponding to the ground-state transition in Ca^{41} was
detected. (auth)

3123

ON THE GEIGER-NUTTALL RELATION. Theodor Sexl.
Acta Phys. Aust. 5, 258-62(1951) Dec. (In German)

The classical Geiger-Nuttall relations are stated to be
of only historic interest; a single, almost linear relation
between the α-decay constant and energy applicable to all
four radioactive families is derived from wave-mechanical
considerations.

3124

MEASUREMENT OF THE HALF LIFE OF Kr^{79}. Pierre
Radvanyi. Compt. rend. 234, 1275-7(1952) Mar. 17. (In
French)

Kr^{79} was formed by the (d,2n) reaction on NaBr with
6-Mev deuterons, and its decay was followed for 9 days.
The value found for its half life was 34.5 ± 0.2 hr.

3125

HEIGHT VARIATIONS IN THE CONCENTRATION OF IONS
NEAR THE GROUND DURING QUIET SUMMER NIGHTS AT
UPPSALA. Harald Norinder and Reinhards Siksna. Tel-
lus 3, 234-9(1951) Nov. (In English)

Results of measurements of the concentrations of small
and large ions (fractions of condensation nuclei) at 0.05-,
0.25-, and 2.10-m altitude under conditions favoring accu-
mulation of radioactive soil emanations are presented.
Characteristic shapes for the variation of the concentration
of ions are illustrated. At the ground the concentration of
small ions increases more than at higher levels, where
also an enhanced content of small ions can be observed
during the stated weather conditions. The number of large
ions decreases after sunset reaching a minimum at sun-
rise. After sunrise a comparatively rapid increase follows.
It seems that the concentration of large ions near the
ground is actually a little below that at the higher levels.
Preliminary explanations of the variations are outlined.

SHIELDING

3126

Goodrich, B. F., Co.
STATUS REPORT; ELASTOMERIC MATERIALS AS
SHIELDING COMPOUNDS FOR NUCLEAR REACTORS,
by W. L. Davidson. Apr. 1, 1952. 16p. (AECU-1952)

Studies are reported on the evaluation of commercial
elastomers and plastics to replace water as a neutron
shield with attendant saving in weight. Elastomers loaded
with heavy fillers are also evaluated for use as total shields.
For a combined γ-ray-neutron shield, rubber compounded
with appreciable loadings of heavy pigments such as metal
powders and metallic oxides can compete in weight with a
standard shield composed of Fe and water. However the
structural strength of the loaded rubber shield would be
greatly inferior to the solid Fe-water combination. Like
other organic compounds, elastomers and plastics are
subject to degradation by high temperature ($\geq 250°F$) and
nuclear radiations. This places a definite limit on the
locations around a reactor where such materials may be
incorporated as permanent shield structures. Attempts to
increase the softening point of polyethylene by the addition
of thermosetting resins were not successful. Attempts to
reinforce natural and butyl rubber with loading pigments

rich in H (TiH_2, $NH_4H_2PO_2$, $(CH_3)_4NBH_4$) have likewise
proved unsuccessful. It was found possible to incorporate
100 volumes of heavy loading pigments into 100 volumes of
rubber. However in so doing one produces compounds with
poor tensile strength compared to the unloaded rubber.
Thirty volumes of loading pigment in 100 volumes of
elastomer produce much better stocks. Many of the loading
pigments employed react with the S in the stock and
effectively prevent vulcanization. Non-sulfur cures have
been developed for certain of these systems. Work has
been done to produce a curable rubber putty which can be
applied with a trowel and will set to a solid after one day
at room temperature. Further effort will be required to make
this material completely satisfactory.

SPECTROSCOPY

3127

Johns Hopkins Univ.
SOME HIGHER ELECTRONIC STATES IN THE MOLECULAR
SPECTRUM OF HYDROGEN AND ITS ISOTOPES, by S. P.
Cunningham and G. H. Dieke. Issued Nov. 1950. 64p.
(NYO-692)

For the purpose of studying interactions between various
states and in order to have accurate data for extrapolation
to the normal state of the H_2^+ ion, the band systems of the
$np^3\Sigma$, and $np^3\pi \rightarrow 2s^3\Sigma$ series have been analyzed for all
isotopic species for which data are available. The results
for ordinary H_2 have been known for some time, but there
were many uncertainties. The present results contain for
the first time the analyses of the $4p^3\pi \rightarrow 2s^3\Sigma$ system for D_2,
T_2, TH, and DH, the $5p^3\pi \rightarrow 2s^3\Sigma$ system for D_2 and T_2, the
$6p^3\pi \rightarrow 2s^3\Sigma$ system for D_2, and the $4p^3\Sigma \rightarrow 2s^3\Sigma$ system for
D_2 and T_2. The molecular constants and the interactions
which lead to Λ-doubling and true perturbations are studied.
This makes possible an accurate evaluation of the H_2^+ con-
stants which agree well with theoretical data. The analysis
was aided greatly by obtaining the spectrum under varied
discharge conditions. In particular the discharge through
a trace of D_2 in an excess of helium was used to eliminate
the higher vibrational states. This type discharge made it
possible to obtain an improved analysis of the $0 \rightarrow 0$ bands
of the 3d and $4d^3(\Sigma, \pi, \Delta) \rightarrow 2p^3\pi$ complexes for D_2. (auth)

3128

Wesleyan Univ., Middletown
MASSES OF Cr^{50}, Cr^{52} AND Fe^{54}, by Henry E. Duckworth
and Howard A. Johnson. Mar. 16, 1950. 6p. (NYO-621)

This material appeared in Phys. Rev. 78, 179(1950) and
was abstracted in Nuclear Science Abstracts as NSA 4-3998.

3129

EFFECT OF INTRINSIC MOMENT OF ELECTRON ON
SPECTROSCOPIC ISOTOPE SHIFT. G. Breit and W. W.
Clendenin. Phys. Rev. 85, 689-90(1952) Feb. 15.

It is pointed out that the intrinsic moment of the electron
has a non-negligible effect on the spectroscopic isotope
shift. Calculations were made for a model in which the
charge Ze is distributed with density proportional to r^{n-2}
in $r < a$, where r is the distance from center of nucleus.
An equation is given for the first-order effect, in a central
electric field, of the magnetic moment μ_e on the energy of
an s electron; the ratio of this effect to the volume effect is
expressed for the model chosen, and for Pb^{208} this ratio was
computed to be -0.050.

3130

THE INFRARED SPECTRA OF CF_4 AND GeF_4. P. J. H.
Woltz and A. H. Nielsen. J. Chem. Phys. 20, 307-12(1952)
Feb.

The infrared spectrum of CF_4 has been remeasured from
2 to 19μ and extended to about 33μ, and the infrared spec-
trum of GeF_4 has been observed from 2 to 38μ. Through the

use of purer samples and more gas than in previous investigations, a large number of new overtones and combination bands were observed in CF_4, and several bands were eliminated as impurities. Identifications of these bands are given. The infrared-inactive ν_2 was observed, probably because of interaction with ν_4 at 435 cm^{-1} in agreement with the Raman line at 437 cm^{-1}. In GeF_4 the two active fundamentals ν_3 and ν_4 were observed at 800 cm^{-1} and 260 cm^{-1}, respectively. Eight overtone and combination bands were discovered. From these the values of ν_1 and ν_2 were calculated to be 740 cm^{-1} and cm^{-1}, respectively. Compared with the fundamentals of $GeCl_4$ and $GeBr_4$, these frequencies seem reasonable. The most striking feature of the spectrum of GeF_4 is the scarity of bands as compared with both CF_4 and SiF_4. (auth)

3131

AN ABSORPTION BAND OF NOCl AT 30 μ. W. H. Eberhardt and T. G. Burke. J. Chem. Phys. 20, 529-30(1952) Mar.

The infrared spectrum of NOCl was examined from 1 to 40 μ. The results agree with those of other investigators with the addition of a strong band with origin at 329 cm^{-1} for NOCl^{35} and at 325 cm^{-1} for NOCl^{37}. The rotational fine structure found in this band and its assignment to the two isotopic molecules is presented. Calculations of the force constants and isotopic shift are summarized in a table.

3132

THE MOLECULAR STRUCTURE OF MoF_6, WF_6, AND UF_6 FROM INFRARED AND RAMAN SPECTRA. T. G. Burke, D. F. Smith, and A. H. Nielsen. J. Chem. Phys. 20, 447-54 (1952) Mar.

This paper is a report of the complete investigation and interpretation of the Raman and infrared spectra of MoF_6, WF_6, and UF_6. The Raman photographs of MoF_6 and WF_6 exhibit three intense lines in accord with earlier measurements on UF_6 in solution. The exploration of the infrared spectra of MoF_6 and WF_6 from 2 to 40μ yielded a great many bands for each molecule. Two of these were quite intense in each case and were identified as fundamentals while the remaining weaker ones were identified as overtones and combinations. The infrared spectrum of UF_6 was repeated from 2 to 17 μ with substantially the same results as in the earlier work. Extension of this spectrum from 17 to 40 μ was made and three new bands were discovered. Because of the great similarity of the spectra of these three molecules, an interpretation of the bands was made along lines suggested by Bigeleisen, Mayer, Stevenson, and Turkevich for UF_6, that the molecule belongs to the point group O_h and has totally symmetric octahedral structure. It was possible to fit all but five very weak bands into an identification scheme based on this model. The success of this effort is taken to be conclusive evidence in favor of the O_h-type symmetry. (auth)

3133

THE INFRARED SPECTRUM OF NITROSYL FLUORIDE. PART II. ROTATIONAL ANALYSIS OF ν_1 AND ν_3. Dale W. Magnuson. J. Chem. Phys. 20, 380-2(1952) Mar.

Analysis of the rotational structure of ν_1 and ν_3 infrared bands of nitrosyl fluoride at 1844.03 and 765.85 cm^{-1} Showed that this molecule is nearly a prolate symmetric top. The following rotational parameters based on symmetric-top theory were found and are expressed in cm^{-1}: for ν_1, 2B$'' = 0.7515$, 2B$' = 0.7483$, $D_J' + D_J'' = 0.0000275$; for ν_3, 2B$'' = 0.7521$, 2B$' = 0.7503$, $D_J' + D_J'' = 0.000002_{38}$. The anharmonic term x_{33} was found to be -1.06 cm^{-1} from ν_3. The anharmonic term x_{12} was found to be $+1.03$ cm^{-1} from ν_1. (auth)

3134

THE INFRARED SPECTRUM OF NITROSYL FLUORIDE. PART I. PRISM SPECTRUM. P. J. H. Woltz, E. A. Jones, and A. H. Nielsen. J. Chem. Phys. 20, 378-80(1952) Mar.

The prism spectrum of NOF is reported from 2 to 38μ. Twelve absorption bands were observed and identified in

terms of the fundamental frequencies ν_1(N—O) = 1844.03 cm^{-1}, ν_2(bending) = 521 cm^{-1}, ν_1(N—F) = 765.85 cm^{-1}. Comparison with the companion molecules NOCl and NOBr is made. (auth)

3135

THE COMBINATION BAND $\nu_1 + \nu_2 + \nu_3$ OF HEAVY WATER VAPOR. F. P. Dickey, C. A. Guderjahn, and E. D. Palik. J. Chem. Phys. 20, 375-7(1952) Mar.

The vibration-rotation band $\nu_1 + \nu_2 + \nu_3$ in the heavy water vapor (D_2O) spectrum has been remeasured. An analysis of the rotational structure has been carried out. From the interpretation of the data the value of the band center has been determined as well as the values of the reciprocals of inertia effective in this vibration state. The frequency $\nu_1 + \nu_2 + \nu_3$ is found to be 6533.4 cm^{-1}. The effective reciprocals of inertia are A(V) = 15.70 cm^{-1}, B(V) = 7.19 cm^{-1}, and C(V) = 4.69 cm^{-1}. (auth)

THEORETICAL PHYSICS

3136

ON THE QUESTION OF FUNDAMENTAL EQUATIONS OF THE RELATIVISTIC QUANTUM THEORY OF FIELDS. N. N. Bogolyubov. Doklady Akad. Nauk S.S.S.R. 81, 757-60 (1951). (In Russian)

3137

RECOIL EFFECT ON ELECTRON-PROTON FORCES AND INAPPLICABILITY OF ENERGY LAW. Gentaro Araki and Sigeru Huzinaga. Progress Theoret. Phys. (Japan) 6, 673-83(1951) Sept.-Oct.

Bethe and Fermi showed that Breit's formula for the two-electron interaction transmitted by photons can be obtained according to quantum electrodynamics if the recoil effect is neglected. It was also shown by Breit that his formula was not in complete agreement with experiment. The discrepancy was shown to come from a term which was proportional to e^4 in the Pauli approximation, but its true origin has not yet fully been known. In the present paper it is shown that this surplus term is due to the neglect of the recoil effect and the discrepancy disappears when the interaction is derived correctly, taking into account the effect of the electron and proton recoils according to the method of unitary transformation. Further it has generally been known that the electron-proton interaction transmitted by photons takes the form which was previously derived by Møller for the two-electron interaction if the conservation law is applied to the total energy of the two particles in the free state. In the present paper it is shown that the application of the energy law gives rise to an incorrect result in case of hydrogen atom. According to Møller's formula the interval between $2^2S_{1/2}$ and $2^2P_{1/2}$ levels of the hydrogen atom becomes too large. Its value amounts to 7273 Mc in contradiction to the Lamb-Retherford experiment. Therefore we arrive at the conclusion that the energy law can not be made use of in general when forces between fermions in the bound states are derived. (auth)

3138

ON THE ADIABATIC NUCLEAR POTENTIAL, I. Kazuhiko Nishijima. Progress Theoret. Phys. (Japan) 6, 815-28 (1951) Sept.-Oct.

The "nuclear force," in spite of its long career, is one of the most complicated unsolved problems in the meson theory. We will investigate this problem on a non-relativistic basis. First, we analyze the special natures fo the phenomena, "nuclear forces." Then making use of the foregoing analysis, we discuss the problem qualitatively, for instance, what kind of approximation we should employ. As the results of these discussions, we can conclude that no single approximation such as weak coupling or strong coupling will be capable of explaining the phenomena, and that the higher order calculations would not be able to help the

situation out of discrepancies, if the adiabatic nuclear po-
tential computed up to 4th order could not fit the experi-
mental data in the low energy region where the weak cou-
pling theory is expected to hold. Second, based on the above
considerations, we calculate the 4th-order adiabatic nuclear
potential by the method of canonical transformations. In or-
der to obtain a meaningful 4th-order adiabatic potential,
it is necessary that the 2nd-order one can be derived in the
Schroedinger approximation without referring to the Pauli
approximation. The derived potential agrees with the one
derived by the S-matrix method. (auth)

3139

RELATIVISTIC TWO-BODY PROBLEM IN QUANTUM
THEORY. Kiyoshi Sakuma, Naomi Shôno and Tadashi
Ouchi. Progress Theoret. Phys. (Japan) 6, 748-61(1951)
Sept.-Oct.

A general method of treating relativistically the two-body
problem in quantum theory is developed on the line of
Dirac's many-time . The case where two charged fermions
interact with each other through the electromagnetic field is
investigated as an example. A canonical transformation is
constructed which eliminates the electromagnetic field
variables in the original Schroedinger equations, and the
potential energy between two charged particles is derived.
Finally, some properties of the simultaneous wave equa-
tions for the system of two particles are discussed, and a
method of treating the stationary state of that system is
indicated. (auth)

3140

ELECTRODYNAMIC DISPLACEMENT OF ATOMIC ENERGY
LEVELS. I. HYPERFINE STRUCTURE. Robert Karplus
and Abraham Klein. Phys. Rev. 85, 972-84(1952) Mar. 15.

The vacuum fluctuations of the photon and pair fields
modify the interaction of an electron with an electromag-
netic field. The effects on the energy levels are conveniently
described in terms of the mass operator and the vacuum
polarization potential. A gage-covariant expansion of the
mass operator for the motion of an electron in a weak ex-
ternal electromagnetic field is derived; the expression con-
tains terms quadratic in the field but includes only the lowest
order electrodynamic correction. The modification in the
Fermi formula is then computed by specializing the external
field to consist of the coulomb and magnetic dipole fields
of the nucleus and by taking the matrix element of the oper-
ators in an S-state of a hydrogen-like atom. All changes can
be described as a correction $\Delta g = -2Z\alpha^2(5/2 - \ln 2)$ in the
gyromagnetic ratio of the electron. The value of the fine-
structure constant deduced from measurements of the hyper-
fine structure becomes $\alpha^{-1} = 137.0364$. (auth)

3141

ON THE MASS DIFFERENCE OF NUCLEONS AND THE
COHESIVE MESONS. Hiroshi Enatsu and Pong Yul Pac.
Progress Theoret. Phys. (Japan) 6, 665-72(1951) Sept.-Oct.

Calculations are given which show that, using the cohesive
meson field, a mass difference exists between the proton
and neutron. The masses of the C mesons were found to be
of the order of this mass difference, the values calculated
were 110 m_e and 13 m_e using the mass of the proton as
1837 m_e. Even though this theory does describe the mass
difference, it does not adequately describe the electromag-
netic phenomena for heavy nuclei nor the convergence of
the fourth-order self-energy.

3142

ON THE ADIABATIC NUCLEAR POTENTIAL. II. Kazuhiko
Nishijima. Progress Theoret. Phys. (Japan) 6, 911-24(1951)
Nov.-Dec.

The 4th-order adiabatic potential is derived assuming the
spinless meson theories. It is shown that the 4th-order
potential becomes larger than the 2nd-order potential even

in the neighborhood of the force range. If this is true then
the strong and weak couplings theories are void, leaving
only the intermediate coupling theory. Thus it is evident that
the higher-order potentials give a larger contribution to the
nuclear forces than has been previously predicted.

3143

V-PARTICLES AND NUCLEAR PHENOMENA. S. Ôneda.
Progress Theoret. Phys. (Japan) 6, 1014-17(1951) Nov.-Dec.

The nuclear phenomena associated with strong interactions
responsible for V and τ particle production are discussed.
According to the coupling, the production processes are (a)
$N + N \to N + V + \tau$, (b) $N + N \to V + V$, and (c) $\gamma + N \to V + \tau$.
The effect on the nucleon moments due to the coupling of
the particles is also discussed.

3144

A CONVERGENT S-MATRIX FORMALISM WITH CORRES-
PONDENCE TO ORDINARY QUANTUM MECHANICS.
P. Kristensen and C. Møller. Phys. Rev. 85, 928-9(1952)
Mar 1.

A consistent theory of nucleons in interaction with mes-
on fields has been developed which permits the determina-
tion of the S-matrix and calculation of cross sections for
the various elementary processes. The requirement is
imposed that the theory must comprise the ordinary
quantum-mechanical description in the limit of slowly
varying fields. It is shown that the form factor can be
chosen in accordance with this requirement in such a way
that the self-energies of the elementary particles are
finite and small compared with the actual rest energies.
Further, the polarization of the vacuum caused by an
"external" meson field is found to be finite.

3145

THE GRAPHS FOR THE KERNEL OF THE BETHE-SAL-
PETER EQUATION. C. A. Hurst. Phys. Rev. 85, 920(1952)
Mar. 1.

The kernel for the two-particle scattering process is com-
posed of "irreducible" parts. These parts are such that it
is not possible, by cutting the two spinor lines carrying the
external energy and momentum, to separate the graph into
two portions such that each portion has exactly four external
spinor lines. As an indication of the possible convergence
of the power series describing the kernel, a lower limit to
the number of irreducible graphs is given. It is found that
there are as many terms in the kernel of the Bethe-Salpeter
equation as in the original perturbation expansion, and so
this kernel may not form a convergent series in the coupling
constant. Neglecting terms would be particularly difficult
to justify in the case of pseudoscalar meson-nucleon inter-
actions, for which the experimentally determined coupling
constant is large.

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA.

Abbreviations used below are:

NSA	-	NUCLEAR SCIENCE ABSTRACTS
ADD	-	ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA
NNES	-	National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948

AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)

AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

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Report	Abstract	Availability	Report	Abstract	Availability
AECD-3026	NSA 5-1971	Phys. Rev. 84, 785-6(1951)	NYO-620	NSA 4-4003	Phys. Rev. 78, 386-90(1950)
3275	6-276	$0.05	714	6-2530	Phys. Rev. 85, 941(1952)
3290	6-893	$0.25	903	5-5921	Phys. Rev. 85, 952-61(1952)
			1509	5-481	Nucleonics 7, No. 1, 18-25(1950); No. 2 19-25(1950)
AECU-567	3-2295	$0.30			
663	4-839	$0.35	1514	5-659	Phys. Rev. 85, 1059-60(1952)
1495	5-4735	Metal Progress 61, 71-5(1952)	1571	6-515	$0.45
1544	5-5022	Proc. Soc. Exptl. Biol. Med. 76, 720-1 (1951)	3030	6-385	Phys. Rev. 85, 1024-9(1952)
1608	5-5640	Nucleonics 10, No. 1, 28-32(1952)	3039	6-1513	Phys. Rev. 85, 932-3(1952)
1642	5-6668	J. Am. Chem. Soc. 74, 1666-8(1952)	3041	6-1489	Phys. Rev. 85, 933-4(1952)
1730	6-784	J. Lab. Clin. Med. 39, 462-79(1952)	3159	6-2321	J. Am. Chem. Soc. 74, 1843(1952)
1749	6-779	$0.10	3259	6-1674	J. Chem. Phys. 20, 518-19(1952)
1810	6-1286	Phys. Rev. 85, 926(1952)	3296	6-2527	Phys. Rev. 85, 944-5(1952)
1819	6-1082	J. Natl. Cancer Inst. 12, 751-63(1952)	ORNL-1131	6-2105	$0.05
1851	6-1838	Phys. Rev. 85, 1040-1(1952)	1239	6-2744	Phys. Rev. 85, 922-3(1952)
BMI-703	6-227	$0.15	RMO-838	6-1401	$0.10
BNL-1005	6-336	Phys. Rev. 85, 937-8(1952)	TID-3023	6-2141	$0.10
1023	6-551	J. Am. Chem. Soc. 74, 1669-71(1952)			
1047	6-1165	J. Chem. Phys. 20, 528(1952)	UCRL-1622	6-2120	$0.10
1067	6-1507	Phys. Rev. 85, 919-20(1952)	1627	6-1864	$0.25
1073	6-1817	Phys. Rev. 85, 929(1952)	1629	6-1927	$0.35
			1637	6-1865	$0.25
DOW-65	6-814	$0.15	1638	6-1641	$0.30
ISC-119	5-3721	Iowa State Coll. J. Sci. 26, 266-7(1952)	1644	6-1866	Phys. Rev. 85, 1062-3(1952)
161	6-1028	Iowa State Coll. J. Sci. 26, 291(1952)	1654	6-2200	$0.25
172	5-6280	J. Applied Phys. 23, 312-15(1952)	UR-157	5-3621	Am. J. Pathol. 28, 171-83(1952)
NP-2255	5-3372	Doklady Akad. Nauk S.S.S.R. 73, 59-62 (1950)	158	5-3622	Am. J. Pathol. 28, 185-91(1952)
			183	5-6563	Cancer Research 12, 222-8(1952)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 1, page "SUPPLEMENT 1".

Nuclide	Data	Reference
$_4\text{Be}_4^8$	Levels $\quad$ $\text{Li}^6(d,n)\text{Be}^7$ $\quad$ 22.58, 23.68 $\quad$ pc	L. M. Baggett, S. J. Bame, Jr., Phys. Rev. 85, 741A(1952).
$_4\text{Be}_5^9$	Levels $\left\{\begin{array}{l}\text{Li}^7(d,n)\text{Be}^8\\ \text{Li}^7(d,p)\text{Li}^8\end{array}\right.$ $\quad$ 17.22, 17.45, 17.80, 18.3 $\bigg\}$ pc	L. M. Baggett, S. J. Bame, Jr., Phys. Rev. 85, 741A(1952).
$_6\text{C}_7^{13}$	$n(\theta)$ $\quad$ $\text{C}^{12}(n,n)$ Level 8.20 $\quad$ J $d_{3/2}$	R. Ricamo, Nuovo cimento 8, 893(1951).
$_6\text{C}_9^{15}$	γ $\quad$ ~5.5 $\quad$ a coin	E. L. Hudspeth, W. B. Rose, Phys. Rev. 85, 742A(1952). C^{14}(1.8 Mev d,p).
$_7\text{N}_7^{14}$	Resonance $\quad$ $\text{C}^{12}(d,n)\text{N}^{13}$ E_0 1.435 $\quad$ Γ(kev) ~6	K. Famularo et al., Phys. Rev. 85, 742A (1952).
$_7\text{N}_8^{15}$	$p(\theta)$ ppl $\quad$ $\text{N}(d,p)$ Level / I: ground $\frac{1}{2}-,\frac{3}{2}-,\frac{5}{2}-$; 6.33 $\frac{3}{2}-,\frac{5}{2}-$?; 8.32 $\frac{1}{2}+,\frac{3}{2}+$; 9.22 $\frac{1}{2}+,\frac{3}{2}+$	W. M. Gibson, E. E. Thomas, Proc. Roy. Soc. (London) 210A, 543(1952). $E_d = 7.89$.
$_8\text{O}_9^{17}$	$p(\theta)$ ppl $\quad$ $\text{O}(d,p)$ Level / I: ground $\frac{5}{2}+,\frac{3}{2}+$; 0.88 $\frac{1}{2}+$	E. J. Burge et al., Proc. Roy. Soc. (London) 210A, 534 (1952). $E_d = 7.73$.
$_{12}\text{Mg}_{12}^{24}$	$\sigma_a(\text{th n})$ $\quad$ 0.033 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950); priv. comm. (1952).
$_{12}\text{Mg}_{13}^{25}$	$\sigma_a(\text{th n})$ $\quad$ 0.27 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{12}\text{Mg}_{14}^{26}$	$\sigma_a(\text{th n})$ $\quad$ 0.06 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{14}\text{Si}_{14}^{28}$	$\sigma_a(\text{th n})$ $\quad$ 0.08 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{14}\text{Si}_{15}^{29}$	$\sigma_a(\text{th n})$ $\quad$ 0.27 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{14}\text{Si}_{16}^{30}$	$\sigma_a(\text{th n})$ $\quad$ 0.41 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{18}\text{A}_{23}^{41}$	$p(\theta)$ ppl $\quad$ $\text{A}(d,p)$ Level / I: ground $\frac{5}{2}-,\frac{1}{2}-$; 1.34 $\frac{1}{2}+$?	W. M. Gibson, E. E. Thomas, Proc. Roy. Soc. (London) 210A, 543(1952). $E_d = 7.81$.
$_{19}\text{K}_{21}^{40}$	$\sigma_a(\text{th n})$ $\quad$ 75 $\quad$ osc	H. Pomerance, priv. comm. (1952).
$_{20}\text{Ca}_{20}^{40}$	$\sigma_a(\text{th n})$ $\quad$ ≤0.22* $\quad$ osc *Ca^{43} contribution unknown	H. Pomerance, priv. comm. (1952).
$_{20}\text{Ca}_{22}^{42}$	$\sigma_a(\text{th n})$ $\quad$ 40 $\quad$ osc	H. Pomerance, priv. comm. (1952).
$_{22}\text{Ti}_{24}^{46}$	$\sigma_a(\text{th n})$ $\quad$ 0.57 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{22}\text{Ti}_{25}^{47}$	$\sigma_a(\text{th n})$ $\quad$ 1.62 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{22}\text{Ti}_{26}^{48}$	$\sigma_a(\text{th n})$ $\quad$ 7.98 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{22}\text{Ti}_{27}^{49}$	$\sigma_a(\text{th n})$ $\quad$ 1.80 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{22}\text{Ti}_{28}^{50}$	$\sigma_a(\text{th n})$ $\quad$ 0 ± 0.2 $\quad$ osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{26}\text{Fe}_{28}^{54}$	$\sigma_a(\text{th n})$ $\quad$ 2.18 $\quad$ osc	H. Pomerance, priv. comm. (1952).
$_{26}\text{Fe}_{30}^{56}$	$\sigma_a(\text{th n})$ $\quad$ 2.55 $\quad$ osc	H. Pomerance, priv. comm. (1952).
$_{26}\text{Fe}_{31}^{57}$	$\sigma_a(\text{th n})$ $\quad$ 2.36 $\quad$ osc	H. Pomerance, priv. comm. (1952).
$_{26}\text{Fe}_{32}^{58}$	$\sigma_a(\text{th n})$ $\quad$ 2.5 $\quad$ osc	H. Pomerance, priv. comm. (1952).
$_{32}\text{Ge}_{38}^{70}$	$\sigma_a(\text{th n})$ $\quad$ 3.3 $\quad$ osc	H. Pomerance, ORNL-577(1949).
$_{32}\text{Ge}_{40}^{72}$	$\sigma_a(\text{th n})$ $\quad$ 0.94 $\quad$ osc	H. Pomerance, ORNL-577(1949).

Nuclide	Property	Value	Method	Reference
$_{32}\text{Ge}^{73}_{41}$	σ_a(th n)	13.7	osc	H. Pomerance, ORNL-577(1949).
$_{32}\text{Ge}^{74}_{42}$	σ_a(th n)	0.60	osc	H. Pomerance, ORNL-577(1949).
$_{32}\text{Ge}^{76}_{44}$	σ_a(th n)	0.35	osc	H. Pomerance, ORNL-577(1949).
$_{34}\text{Se}^{74}_{40}$	σ_a(th n)	44	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{34}\text{Se}^{76}_{42}$	σ_a(th n)	82	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{34}\text{Se}^{77}_{43}$	σ_a(th n)	40	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{42}\text{Mo}^{96}_{54}$	σ_a(th n)	1.2	osc	H. Pomerance, priv. comm. (1952).
$_{42}\text{Mo}^{97}_{55}$	σ_a(th n)	2.1	osc	H. Pomerance, priv. comm. (1952).
$_{42}\text{Mo}^{98}_{56}$	σ_a(th n)	0.38	osc	H. Pomerance, priv. comm. (1952).
$_{42}\text{Mo}^{100}_{58}$	σ_a(th n)	0.5	osc	H. Pomerance, priv. comm. (1952).
$_{47}\text{Ag}^{108}_{61}$	β^-	1.49	scin	M. Goodrich, E. C. Campbell, Phys. Rev. 85, 742A(1952); priv. comm. *Relative intensities.
	β^-/K	~2		
	γ ~1*	0.19	scin	
	~1*	0.42		
	~4*	0.61		
	$\gamma\gamma$, no $\beta\gamma$			
	Pd K X-rays			
$_7\text{Ag}^{110}_{63}$	γ 1.00*	0.652	s;Cpt	B. S. Dzhelepov et al., Doklady Akad. Nauk, SSSR 77, 597(1951); Guide to Russ. Sci. Lit. 4, 369(1951).
	1.03	0.886		
	0.26	1.388		
	0.22	1.484		
	*Relative intensities			
$_{52}\text{Te}^{120}_{68}$	σ_a(th n)	68	osc	H. Pomerance, T. Arnette, ORNL-940 (1950); priv. comm. (1952).
$_{52}\text{Te}^{122}_{70}$	σ_a(th n)	2.7	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{52}\text{Te}^{123}_{71}$	σ_a(th n)	390	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{52}\text{Te}^{124}_{72}$	σ_a(th n)	6.5	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{52}\text{Te}^{125}_{73}$	σ_a(th n)	1.5	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{52}\text{Te}^{126}_{74}$	σ_a(th n)	0.77	osc	H. Pomerance, T. Arnette, ORNL-940 (1950); priv. comm. (1952).
$_{52}\text{Te}^{128}_{76}$	σ_a(th n)	0.3	osc	H. Pomerance, T. Arnette, ORNL-940 (1950); priv. comm. (1952).
$_{52}\text{Te}^{130}_{78}$	σ_a(th n)	0.5	osc	H. Pomerance, T. Arnette, ORNL-940 (1950).
$_{56}\text{Ba}^{134}_{78}$	σ_a(th n)	2	osc	H. Pomerance, priv. comm. (1952).
$_{56}\text{Ba}^{135}_{79}$	σ_a(th n)	5.6	osc	H. Pomerance, priv. comm. (1952).
$_{56}\text{Ba}^{136}_{80}$	σ_a(th n)	0.4	osc	H. Pomerance, priv. comm. (1952).
$_{56}\text{Ba}^{137}_{81}$	σ_a(th n)	4.9	osc	H. Pomerance, priv. comm. (1952).
$_{56}\text{Ba}^{138}_{82}$	σ_a(th n)	0.68	osc	H. Pomerance, priv. comm. (1952).
$_{58}\text{Ce}^{136}_{78}$	σ_a(th n)	25	osc	H. Pomerance, priv. comm. (1952).
$_{58}\text{Ce}^{138}_{80}$	σ_a(th n)	8.7	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{58}\text{Ce}^{140}_{82}$	σ_a(th n)	0.63	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{58}\text{Ce}^{142}_{84}$	σ_a(th n)	1.76	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{74}\text{W}^{180}_{106}$	σ_a(th n)	30	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{74}\text{W}^{182}_{108}$	σ_a(th n)	19.2	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{74}\text{W}^{183}_{109}$	σ_a(th n)	10.9	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{74}\text{W}^{184}_{110}$	σ_a(th n)	1.97	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{74}\text{W}^{186}_{112}$	σ_a(th n)	34.1	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{75}\text{Re}^{185}_{110}$	σ_a(th n)	100	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{75}\text{Re}^{187}_{112}$	σ_a(th n)	63	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{81}\text{Tl}^{203}_{122}$	σ_a(th n)	11.0	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).
$_{81}\text{Tl}^{205}_{124}$	σ_a(th n)	0.77	osc	H. Pomerance, ORNL-1164(1951); priv. comm. (1952).

AVAILABILITY OF AEC RESEARCH AND DEVELOPMENT REPORTS

The Reports Reference List indicates the declassified and unclassified research reports which are abstracted in this issue of Nuclear Science Abstracts.

Many of these reports are or will be published in the scientific and technical journals or in volumes of the National Nuclear Energy Series. Upon publication, the report is listed in the supplements to the Numerical Index of Reports, found in the back of each issue of Nuclear Science Abstracts.

Reports not intended for publication are sent to the AEC depository libraries listed below as soon as possible after being abstracted. (Some of this group are also for sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C., which will send price lists upon request.)

HOW TO LOCATE AEC REPORTS

If the AEC report number is known, the searcher should go directly to the cumulative Numerical Index of AEC Reports in Nuclear Science Abstracts, Volume 5, No. 24, Dec. 31, 1951, or, for recent reports, to the supplements to this index in each issue beginning with Volume 6, No. 1 (Jan. 15, 1952). The Numerical Index of Reports includes a complete list of AEC reports, by number, giving the related abstract number and (where applicable) the journal reference, the National Nuclear Energy Series citation, or the availability through the Office of Technical Services. (Where no indication of availability is given, the report is or will be found at the depository libraries.)

If the AEC report number is not known, searching is aided by the Subject and Author indexes of Nuclear Science Abstracts. The indexes refer to an abstract from which the report number may be noted. Declassified reports numbered through 2023 are indexed in the separate, Declassified Documents Cumulative Index, and their abstracts appear in the journal, Abstracts of Declassified Documents. (Both index and journal are available at depository libraries and are for sale by the Office of Technical Services.)

More complete information is given in a pamphlet, "Availability of USAEC Research and Development Reports," which may be obtained upon request from the Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

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